THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XX. Copyright, 1886, TICKNOR & COMPANY, Boston, Mass. No. 572.

DECEMBER 11, 1886.

Entered at the Post-Office at Boston as second-class matter.

CONTENTS

SUMMARY: —
The Twentieth Annual Convention of the American Institute of Architects. — "Official Organs." — Ways of Benefiting by the Increase in the Copper Out-put. — The Dangers of Living in New Houses. — M. and Mme. Dieulafoy's Discoveries in Persia. — Computing Excavation-work. — The Telephone as a Barometer. 273
ARCHITECT, BUILDER AND OWNER BEFORE THE LAW. — II. . . . 275
THE TREATMENT OF SEWAGE. — V. 276
THE ILLUSTRATIONS: —
House, Dorchester, Mass. — House, near Cincinnati, O. — Bank Building, Philadelphia, Pa. — House, Boston, Mass. — Old Colonial Work, Boston, Mass. — House, Long Island, N. Y. . 279
EXPLORATIONS IN THE OHIO VALLEY. 279
SO-CALLED BRIBERY OF ARCHITECTS. 282
SOCIETIES. 282
COMMUNICATIONS: —
Mill-floors. — The Manhattan Storage Warehouse Plate. — The Right to Reject Bids. 282
NOTES AND CLIPPINGS. 283
TRADE SURVEYS. 284

THE Convention of the American Institute of Architects, held in New York last week, seems to have been a pleasant, and in some respects an important one. The Secretary, Mr. Mason of Newport, was unfortunately detained at home by a severe accident to his father, but the business of the Convention was not materially interrupted. Members were present from the South and West, as well as the Northern and Middle States, and Mr. M. E. Bell, the Supervising Architect of the Treasury Department, set an example which we hope will hereafter be regularly followed by those who may be appointed to this important office. Naturally enough, the committee which drew up last year, in conference with a committee of the Western Association of Architects, the draft of a bill for the reorganization of the architectural service of the Government, desired to take advantage of Mr. Bell's presence to consult with him on this important subject, more particularly since it had been assured that the Conference bill could not pass Congress; and on motion the committee was formally instructed to confer with Mr. Bell, with a view to substituting for the defective measure another draft, better suited to the circumstances which Congress must take into consideration. We shall hope later to present the various addresses and reports in full, so that we need not here attempt to give abstracts of them, even if the meagre accounts in the daily papers enabled us to do so; but it cannot be doubted that they were even more interesting than usual, as reflecting the remarkable growth in influence and importance of the profession during the past year. Of the various discussions, and of the papers read before the Convention, we have hardly more than the titles, but it appears that Mr. Charles F. Wingate, one of the most interesting and suggestive of writers, presented an essay upon the character of the soil under buildings, in which he affirmed that nine-tenths of all diseases were traceable to bad soil, and suggested that architects should take greater pains to ascertain the quality of the ground on which they built, and the methods of improving it. The officers for the next year, as we find the list given in the papers, are Mr. Thomas U. Walter of Philadelphia, who is reëlected as President, and may, we trust, be spared to us for many more reëlections; Mr. O. P. Hatfield of New York, reëlected as Treasurer; Mr. A. J. Bloor of New York, elected Secretary, to succeed Mr. Mason of Newport; and Messrs. Congdon, Le Brun, Littell and Upjohn, all of New York, as Trustees. On the return of Mr. Bloor to the position which he filled so ably and with so great self-sacrifice, years ago, we congratulate the profession most sincerely. Few persons have any idea of the amount of care and labor imposed upon the Secretary of the American Institute of Architects, or of the thoughtful discretion which the holder of that office, as the tangible representative of the profession in the United States, must exercise in answering the innumerable questions asked of him; and if Mr. Bloor, after experiencing so long the cares incident to a most efficient administration of the office, is willing to assume them again, it seems to us that he deserves the lasting gratitude of the profession. We have always thought that the Secretary of the Institute should be well paid for the time and trouble which he must devote to its affairs, and hope that it will not be long before the Convention will come to the same conclusion; but, meanwhile, we are sure that the older members of the Institute, at least, will recognize the debt which it already owes Mr. Bloor, and which may later, we trust, be acknowledged in some more conspicuous manner.

WE regret to notice that during the discussion of the matter of an "official organ" by the Western Association of Architects one speaker referred to the fact that the *American Architect* was early in its career selected by the American Institute of Architects as its "adopted organ for purposes of publication" in such a way as to create the impression that we had made capital of the vote in our dealings with advertisers. The speaker was also somewhat in error as to the foundation of this journal, and we refer him and others interested to the account we gave in our issue for August 13, 1881. So far as we can recall, the fact that the Institute had made the selection referred to — which considering the limited possibilities was not any more flattering than it could help being — was never paraded in this journal itself, though it was probably mentioned in circulars issued during the first year of publication. We have always considered that our acceptance of the office to which we were appointed imposed on us only the duty of publishing without expense to the Institute such papers, reports and documents as it might desire to place before the profession, and which we considered not too voluminous to find a place in a weekly journal. We have not considered that the *American Architect* was the mouth-piece of the Institute, to express its views, uphold its recommendations and advance its theories. Moreover we have never made any special attempt to procure independent reports of its proceedings in convention, feeling that the Institute's officials would furnish us whatever reports it was proper should appear in the Institute's "official organ for purposes of publication."

A STORY is circulating through the newspapers to the effect that a copper-mine has been discovered near the line of the Canadian Pacific Railroad, which furnishes ores so rich, and so easy of reduction, that except for the duty which the United States imposes on metals, ingots of copper from this mine could be sold in New York at a profit for four cents a pound. It is not very likely that more than half of this story is true, but if even half can be depended upon, no news more important to the art of building has been published for a long time. We soon forget the fluctuations in the prices of materials which we use constantly, but the stock-list will serve to remind us that it is only six years since copper sold in New York for twenty-four and seven-eighths cents per pound, and that eight years previously contracts were made at forty-five cents, which is by no means the highest price on the list. At eleven cents, which has been the average rate for a year or two past, this invaluable material costs less than half as much as it did in the dull times of 1880, and the effect of the low price is already apparent in the great extension of its use. Where copper roofing was once considered a luxury, which only the richest could afford, it is now in daily use by men of moderate means, and copper steam-boilers are, if we are not mistaken, already made for those who can afford to make a great future economy by a present sacrifice. The next step should be copper stove-pipes, and even these are now occasionally seen, while sheet-metal stoves themselves are not unlikely to follow, before long, the example which has been set them by the gas-stoves. If the competition of the great Canadian mine should still further reduce the price, copper will undoubtedly take to a great extent the place which tin, zinc and sheet-iron have occupied; and even for castings for stoves and hot-water or sectional steam-boilers, it would be found hardly more expensive, aside from the enormous profits charged upon such goods, and infinitely better.

AN old alarm has, according to the *Builder*, been revived in Germany by Dr. Hülmann, who lectured recently in Halle on the dangers of living in new houses. According to him, the close-fitting of new doors, window-sashes and floors prevents the ingress of fresh air from the outside, while the moisture present in the pores of the new plastering obstructs

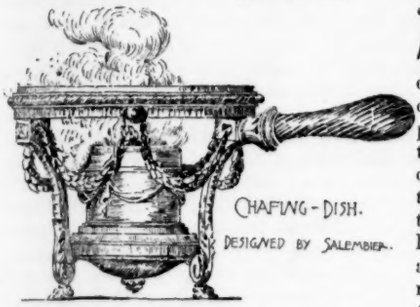
the transpiration of air through it, and aggravates, by the dampness which it communicates to the rooms, the other bad effects of imperfect ventilation. For these reasons, which he enforces by terrifying pictures of the consumption of oxygen, and the formation of carbonic acid in the atmosphere of inhabited rooms, he proposes that no dwelling should be occupied until its walls have been completely dried out, and the time necessary for this drying he considers to be two or three years. A part of this period, he thinks, is taken up by the transformation of the hydrate of lime in the fresh plastering into carbonate, which takes place under the influence of the carbonic acid of the air, and sets free the water of hydration, which fills the pores of the plastering until it has all evaporated; and he proposes that the reaction should be hastened by burning charcoal in the rooms, so as to supply carbonic acid more rapidly. This is by no means a new idea, but as the carbonization of the lime hydrate seldom extends for more than an eighth of an inch below the surface, the danger to health caused by the dampness exhaled from so thin a stratum must be infinitesimal, while the change of air, which the filling of the pores of the plastering with water is supposed to prevent, would be much better secured by means of appropriate ventilating flues. In fact, the health authorities of Berlin itself do not seem to be quite in accord with the Halle sanitarian in regard to the matter, for, instead of requesting the owners of new houses to wait before moving into them until the floors and doors have shrunk so much as to admit a suitable supply of fresh air, as the law authorizes them to do, they now propose to insist upon the ventilation of all dwelling-houses by more efficient methods, and to cease troubling proprietors about the stoppage of the pores in the skim-coat of their rooms.

WE take no little pride in thinking that M. Dieulafoy, whose energetic investigations into ancient Persian architecture have already won for him the highest distinction among working archæologists, and for his devoted wife the very unusual distinction, for a lady, of the decoration of the Legion of Honor, is not only an engineer eminent in his profession, but one of the editors and managers of the *Revue Générale de l'Architecture;* and there can hardly be a doubt that his double set of accomplishments, as an engineer and a student of architecture, have helped him both to make and to understand the discoveries which are now beginning to attract the attention of the civilized world. Until within a few years, the wonderful tales handed down to us from antiquity, about the wealth and luxury of the Medes and Persians, have been received with a certain incredulity, due less to any intrinsic improbability in the stories themselves than to the difficulty of realizing the magnificence of cities and palaces of which now no trace remains; but the labors of M. Victor Place at Khorsabad, and of Mr. Layard at Nineveh, have prepared us, by their revelations of what the Assyrians did, for what M. and Mme. Dieulafoy have discovered about the Persians in Susiana. At Susa, which still retains, almost unchanged, its ancient name of Shushan, these explorers have been able to trace the disposition of all portions of the enormous winter-palace of the kings of Persia, and have discovered innumerable remains of the palace walls and sculptures. The whole building, as shown by these explorations, covered an area of two hundred and fifty acres, or about five-eighths of a mile square. According to the ancient writers, it was all of pure white marble, and the pillars were covered with gold and precious stones, but M. Dieulafoy finds that a considerable portion, at least of the exterior enclosures, was of enamelled brick, arranged in such a way as to form ornamented bands, and even long friezes of figure subjects, of the most effective character for external decoration. Within the first enclosure, which, as usual in Persian and Assyrian buildings, was reached by a vast staircase, stood the palace proper, preceded by the throne-room, which seems to have been about two hundred feet square, and sixty-five feet high, perhaps open in the middle to the sky, but surrounded by a double colonnade. Very little of the material of this room, which was probably quite richly decorated, has yet been found, but a huge capital, sixteen feet high, formed of two gigantic horses' heads, has been discovered in the throne-room, which indicates that this, like most Persian rooms, was covered, at least in part, with a wooden ceiling, supported on heavy beams. Further excavations will doubtless bring to light more traces of that almost inconceivable luxury which reigned in the court of the Persian kings, but for the present the outer walls alone have been sufficiently uncovered to afford us much knowledge of their construction. The main mass of these, which were double, measuring together three hundred and twenty-five feet in thickness, was of unbaked brick, probably faced with enamelled bricks, which are found in great quantities among the débris. As in other parts of Persia and Assyria, these enamelled bricks are shaped like truncated pyramids, having the base only enamelled. The colors of the enamel are principally a sea-green, a greenish or turquoise blue, a yellow, and a brownish purple. The tints and surface of the enamel are well preserved, and the bricks, which appear to be of a sort of concrete, rather than clay, have evidently been exposed to a great heat. The frieze of figures, which represents a procession of soldiers, has a ground of blue and green bricks, and the figures, which are also in bright colors, are raised about an inch and a half from the ground. This must have given a singular brilliancy to the effect, and the description of the whole treatment has many suggestions for modern architects.

ARCHITECTS often have occasion to manage tolerably extensive operations of filling and grading, and many of them have probably wished that there might be some way of estimating a little more accurately than is possible by the common rules, the volume that a given quantity of earth will occupy after a year's settling into its place. The late Mr. Trautwine, who was an extremely practical man, estimated that while a given bulk of earth, loosely thrown out, would at first occupy "in the fill" a space about twenty per cent greater than in the excavation, it would ultimately settle down so as to occupy a volume smaller than the original excavation in a proportion varying from an ultimate shrinkage of eight per cent in gravel, and ten per cent in clay, simply dumped into place, to twenty-five per cent in puddled clay; and these observations, although there is something surprising in the idea that six cubic yards of clay, measured in the cart, will only just fill a hole having a capacity of three-and-three-quarters cubic yards, seem to be approximately correct. In France, even among the accomplished engineers employed on public works, it has been customary, according to the *Annales des Ponts et Chaussées*, to neglect altogether the shrinkage of clay in the fill, on the theory that as earth-work rarely consisted exclusively of one sort of material, the shrinkage of the clay contained in a bank would be compensated by the swelling of the other materials, and where rock, which occupies in an embankment about seventy per cent more space than in the original ledge, forms a part of the material used, this rough averaging of the swelling and shrinkage might do well enough. In clay regions, however, it seems to fail lamentably, and in a recent case, where extensive earth-work was carried out in the clayey soil about Calais, the discrepancy in bulk between the dimensions of the excavation and those of the mass of earth taken from it was so striking that for some time the engineer in charge was supposed to have made a mistake in his profiles or calculations. In order to make sure whether this was so, new measurements were made, both of the excavation and the "fill," and it was proved beyond a doubt that a portion of the material, consisting only of clay, had shrunk to a space twenty-three and one-half per cent smaller than that which it had occupied before excavation; while the remaining portion, which had contained a vein of gravel, had shrunk twenty-two per cent. Whether this clay had been puddled or rammed on being put in place does not seem quite clear, but it seems probable that this was the case.

WHOSE of our readers who have telephones in their houses or offices may like to try the following method described in *Le Génie Civil*, of utilizing them for foretelling storms. The first step is to plant in any moist or damp ground two bars of iron, split at the lower end, in order to increase the surface in contact with the earth. The bars should be set fifteen or twenty feet apart, and every week or two the ground at their base should be watered with a solution of chloride of ammonium. Each of the bars is then to be connected with the conducting wire of a telephone in the neighborhood. If this is done, it will be possible, by listening at the telephone, to perceive the approach of storms twelve or fifteen hours before their arrival, and even to notice changes of temperature. A coming tempest produces in the telephone a sound like that of fine hail falling upon a tin roof, while lightning is shown by a short dull sound, and a change of temperature is accompanied by a warbling like that of a flock of birds at a distance.

ARCHITECT, BUILDER AND OWNER BEFORE THE LAW.[1]—II.



A STILL more striking instance of the disposition of courts to prevent people from using the technicalities of the law to evade their obligations is to be found in an Illinois[2] case, where an agreement was made by the abuttors on certain streets for having the roadway covered with gravel. A written contract was drawn up, under which all the abuttors, who were described in it by name, were mentioned as parties, and two of them were appointed as a committee to sign it on behalf of all. One of the abuttors, who may be called A. X., was authorized by a neighbor, whom we will call B. X., and who was one of the committee appointed to sign the contract, to sign the document for him, and did so under the form "B. X. by A. X.," but did not sign it on his own account. A. X. subsequently refused to pay his part of the cost of the gravel, saying that he did not sign the contract, and was not bound by it, but the Supreme Court held that his signature as agent for another person indicated that he had read the contract, and if he had done so he must have seen that he was himself mentioned in it, and that it was intended to bind him as well as the other abuttors, and having under these circumstances signed it as agent for another person, without at the time protesting against his own name being included as a party to the agreement, he must be presumed to have assented to it, and his signature for B. X. ought to be regarded as sufficient evidence that he, as well as the person for whom he signed, intended to be bound by it. In cases where there is a doubt whether the contract is really to be performed within a year, and consequently, whether it must be written and signed, or not, the courts, where there is no indication that any false or improper claim is made, generally hold that although the employment to which the contract relates may not have been actually carried through within a year, still if it could have been so carried through, the agreement relating to it does not fall within the Statute of Frauds, and may be recognized and enforced at law, although not in writing. This view of the subject has a particular interest for architects, who often make verbal contracts for planning and supervising building operations which extend over a much longer time than a year, and, although it would be unwise to encourage them in this hazardous practice, it may not be amiss to say that the conceptions of courts as to the amount of building that might be done within twelve months, if necessary to save a man from undeserved hardship, are based on the most liberal estimates of the rapidity with which it is possible for mechanics to work.

It must be observed, however, that the sanguine fancy of the jury in this regard will not be allowed to be brought into play if the contract or specification, or any other evidence relating to the engagement between the architect and his employer, shows that it was not intended or expected, at the time when the engagement was made, that his task would be completed within a year. If, for instance, as not unfrequently happens, an architect is employed to render the usual professional services in connection with a building to be erected or altered "when the leases expire," or when anything else happens which as both parties know, cannot occur within a year, he should be careful to have his engagement in writing, signed by his client, or he will find his contract, if it should be put to the test, void. If he has done any work for his client, such, for instance, as the preparation of the plans, before receiving notice that the other party abandoned the agreement, it seems to be the rule that he can recover a proper price, to be determined by the jury, for such services as he has already rendered, but the absence of a written contract in such cases debars him from claiming, as he might otherwise do, his full fee, as well as damages, in case his client should think fit to discard him before the work was begun, or while it was in progress, and appoint some one else in his stead.

In the case of works carried out under the ordinary circumstances, it might be thought that a clause in the contract with the builder, drawn up by the architect, and specifying a date for the completion of the building more than twelve months from the time of the engagement of the architect who was commissioned to design and supervise the work, would bring the contract between the architect and the owner within the Statute of Frauds, and make it void if not in writing: but the architect is, under such circumstances, protected to some extent by the consideration that it might not have been known, when he agreed with his client, that so long a time would have to be allowed for the building operations; and even if this resource should fail him, it has been held that the assignment, in a verbal contract for building, of a date of completion more than a year from the time when the contract was made, did not bring the contract within the Statute of Frauds, for the reason that the agreement in fixing the date "at or before" which the building should be finished, did not forbid the builder to complete it many months before the contract time, if he wished to do so, and thus fulfil his agreement within the year, while the statute related only to contracts which obviously could not be completed within that time.

Unless the agreement between the architect and his employer relates to work which is not to be performed within twelve months from the time of making the agreement, or unless the former's services are rendered or promised in consideration of marriage, which is naturally not a common experience among architects, or unless the architect is to receive a piece of land or other real estate as compensation for his services, it is not necessary that the agreement should be in writing. On the contrary, it may be verbal, or implied, or partly written, and partly verbal, or implied, and will be just as binding as if written, and signed by the parties, and can, if there is no difference of opinion between the parties as to what the agreement was, be as easily enforced at law as a document in writing. Unfortunately, men are in such matters too often forgetful and careless. They do not pay attention to what is said to them, and forget what they said in reply, and it is consequently very common to find the parties to a verbal contract a few weeks afterward differing widely, although perhaps conscientiously, as to what it was that they mutually agreed to do. In case of a controversy on the subject the testimony of one party about the agreement, if no fraudulent intent is apparent, is just as good as that of the other, and whether a jury decides that one party is wholly right, and the other wholly wrong, or strikes an average between the two claims, as it is more disposed to do in doubtful cases, there is sure to be disappointment on one side or the other. Architects, who are accustomed to hearing the conflicting assertions of their clients and the contractors as to what agreements or promises have been made during the progress of works under their charge, hardly need examples of the distortions which the remembrance of facts will suffer under the influence of self-interest; but it may be well to remind them of the numerous instances in which members of their profession, after having done work in pursuance of a verbal engagement, have been met, on presenting a bill for their services, with the answer that the party who employed them perfectly well remembered that they had agreed to render those services for nothing. In many cases the employer honestly believes this, basing his belief perhaps on some remark or action of the architect which neither can accurately recall, and if the architect fails to convince the other of his error, or refuses to accept a compromise in the matter of his bill, he must be prepared to hear his employer swear in court solemnly, and in good faith to facts which never existed outside his own imagination. To do the courts justice, they are generally unwilling to believe, without better evidence than unsupported assertion, that any professional man would be foolish enough to spend his time and skill for nothing; but, to use the words of an American judge, if two equally credible persons give directly opposite testimony, the testimony of one "neutralizes" that of the other, and the architect who is so unhappy as to become involved in a dispute in which he has nothing but his recollection of a verbal agreement to rely upon is likely to find the compensation which he recovers measured by something more than the residue which remains after deducting his opponent's claims from his own. There will be much more to say upon this subject when we come to the relations of the builder with the other party to his contracts, but architects will do well to take notice that as they are more likely than builders to make their contracts orally, so the results of their labors being less tangible than those of the builder's work, they are often worse prepared to convince a jury of the justice of their claims.

[1] Continued from page 228, No. 568.
[2] Keytoot *vs.* Cromwell Mound Co., 115 Ill., 502.

The best remedy for the inconveniences and dangers of verbal contracts lies in the provision of written memoranda, which will not only serve to refresh the memories of the parties themselves, but, if a controversy in regard to the contract should be brought into court, will be of the greatest importance as evidence. In fact, so great is the value which the law attaches to writing, that if either party can produce a letter or written memorandum of any kind which goes to show what the terms of an agreement were, a court will generally decline even to listen to a witness who endeavors to refute, by quoting mere conversations, the evidence afforded by the written document. It is not necessary that the writing should be in the shape of a formal contract. Letters, with replies to them agreeing to the terms proposed in them, are excellent evidence of the intention of the parties, and an agreement made in this way cannot easily be broken by either party. So also, if an architect, for example, should write to an intending client, mentioning his terms for his services, or, as is often done, enclosing a tariff of prices, and the other should not at the time make any objection, but should request the architect to proceed with the work, and should suffer him to carry it to completion, the letter would be regarded as showing the terms agreed to between the parties, and only strong and direct evidence of its having been verbally set aside would be admitted to contradict it. Even if the person to whom the architect offered his services on certain terms should not actually request him to render those services, but should offer no objection to his doing so, and confer with him or otherwise recognize his actions as the work went on, and should at the end profit by his labors, he would be assumed, unless he could show evidence to the contrary, to have agreed to the terms which the architect proposed at the beginning.

In default of formal agreements, or of terms submitted in writing by one party, and either expressly or tacitly acquiesced in by the other, a comparatively vague memorandum of the agreement, or of the understanding existing at the time between the parties will be much better than nothing, and will give the one who can produce it a great advantage over persons who have nothing to depend upon but their own assertions in regard to the circumstances, which are very likely to be flatly contradicted by the assertions of the opposing party. In such cases, even a memorandum of the terms agreed to, or the request made by the party to be charged, or of any other item of the understanding between the parties, made by the person who afterwards desired to profit by it, would be far better than nothing, and if he could satisfy the jury by the examination of the note-book in which it was written that it was made at the time, and in good faith, he might find it of considerable service.

Still better than this, in the case of a verbal contract of any kind, is a note of the circumstances of the agreement, made by a third party, especially if the third party was a person familiar with the subject-matter of the contract, and was present when the verbal agreement was made, and took note of it at the time in writing. In the absence of a written document signed by the parties, or of a letter from one of them expressing the terms which he offered, with written or tacit acceptance of them by the other, such an impartial memorandum would have great weight, and could hardly be contradicted by the mere recollection of one of the parties. Although architects are not, perhaps, likely to need such testimony very often in their own behalf, they may be of great service to their clients by remembering the value of it, and acting themselves as the impartial takers of notes in regard to bargains made between their clients and others in their presence. As all architects know, the approaching completion of a building, particularly of a dwelling-house, usually serves as the signal for a multitude of minor agreements, relating to grading, planting, furnishing and other matters. Although the proprietor commonly makes his own bargains for these matters, the architect is frequently consulted about them, and is in consequence often present when the agreements are made, and, as the agreements are almost always verbal, and consequently liable to be misunderstood or partially forgotten on one side or the other, the architect can help both parties, but his client more particularly, by writing down the items of the bargain, with the date and other important circumstances, in such a way that his note can be subsequently referred to. It is an excellent precaution, also, particularly where one of the parties is a gardener or contractor, not much used to exact expression, to read the memorandum to the parties, and ask them if that is their understanding of the agreement, adding to the memorandum a note of this question and the reply.

As in most of their worldly affairs, so in the making of contracts, men are generally in too much of a hurry for their own good, and forget, or leave out, or stumble vaguely over, or postpone for future consideration, the very points which it is most necessary for them to have most clearly understood. Some persons are afflicted with an excessive timidity or politeness, which leads to an habitual fogginess of expression in their business dealings, as if they feared to wound the feelings of others by a brusque directness of demand or reply, and many more, under the influence of a craftiness which is not incompatible with timidity, habitually conceal their real intentions, and make their bargains in vague terms, to which they hope to be able later, after they have been accepted, to ascribe a meaning very different from that which the party who accepted them had in mind, and much more advantageous to themselves. It is true that the courts generally make short work of these astute practices, and it is often laid down on the highest authority that the true interpretation of an agreement, and the one to which the law must give effect, is that interpretation which the man who proposes the agreement thinks that the person to whom he proposes it puts upon it at the time; or, to say the same thing in another way, any uncertain or incomplete expression in a contract must be understood in the way in which he who proposed the contract thought that the other party then understood it; but, although architects will do well to remember this, which is the rule by which the law interprets contracts, when they have to decide between their clients and their contractors in regard to imperfectly defined stipulations, they should beware of admitting any such incomplete or ambiguous expressions to their own negotiations with either client or contractor. The principle to be always borne in mind is to describe all the stipulations on which it is desired to insist as plainly as possible, leaving nothing to be inferred or supplied. Architects are apt to fear offending their clients by appearing too anxious, at the beginning of their relations, about their fees, but a man of moderate tact need have no apprehensions on this point, and for one client who really intended to pay a proper fee, and who was driven away by being asked to signify his intention definitely at the outset, there would be a thousand who would be glad to start with a definite understanding between themselves and their architects as to the services to be rendered, and the compensation to be paid for them.

Taking things, however, not as they should be, but as they are apt to be, we must see what the law will do for a man who neglects to protect his own interests by saying distinctly what he proposes to do, and what pay he expects for doing it, and getting the assent of the other party to his proposition, before he enters upon any undertaking.

[To be continued.]

THE TREATMENT OF SEWAGE.[1]—V.

DEODORIZATION OF SEWAGE.

TO get rid of the offensive smell of sewage has been a fruitful subject for investigation. Since the time of Davy, who investigated the deodorizing power of different chemicals on night-soil, numerous experimenters have worked at it.

The following are the results of Letheby's experiments showing the quantities of different disinfectants required to deodorize ordinary London sewage. The substances were added until subsequent decomposition was entirely prevented, or more sewage smell removed.

[1] A paper by Dr. C. Meymott Tidy, read before the Society of Arts, April 14, 1886, and published in the *Journal* of the Society. Continued from No. 570, page 257.

Dr. Letheby notes that no doubt a less amount would suffice, provided the precipitate produced by the several chemicals was removed as fast as formed: —

	Grains required per gallon.	Results as to deodorization.	Composition.		
Quicklime	12	Incomplete.			
Chloride of lime	8	Complete.			
McDougall's powder	40	Incomplete.			
Peat charcoal	150	do.			
Condy's liquid	150	Complete.	4,357 grs. per gal. of Permanganate of potash	sp. gr.	1055
Dale's "	315	Incomplete.	61,827 grs. per gal. of Perchloride of iron	"	1470
Ledoyen's "	1090	do.	8,120 grs. per gal. of Nitrate of lead	"	1160
Ellerman's "	470	do.	43,434 grs. per gal. of Muriate and pyrolignate of iron	"	1443
Burnett's "	100	do.	60,031 grs. per gal. of Chloride of zinc	"	1594

The cost may be thus stated:

	Price at.			Cost for deodorizing 100,000 gallons.		
	£.	s.	d.	£.	s	d.
Quicklime	0	10	0 per ton.	0	0	9
Chloride of lime	15	0	0 "	0	15	4
McDougall's powder	12	0	0 "	3	1	3
Peat charcoal	3	5	0 "	3	2	3
Condy's liquid	0	1	0 per gal	10	14	4
Dale's "	0	0	6 "	11	3	7
Ledoyen's "	0	0	4 "	23	16	4
Ellerman's "	0	0	9 "	25	3	6
Burnett's "	0	4	0 "	28	12	0

STRAINING, FILTRATION AND SUSIDENCE.

Many attempts have been made not only to strain and filter sewage, but also to allow the deposition of the larger pieces of the suspended matters in tanks, with or without straining. As a fact, it is impossible to strain sewage efficiently, or to effect deposition without previous treatment. If the straining material be of fine texture, such as of wire, it soon clogs, whilst if it be of coarse texture, it is of no use. If fine gauze, or an iron grate be used, the albuminous matters soon choke it, and prevent further action. In Baldwin Latham's self-cleansing extractor, an ingenious contrivance in use at Dantzic, Croydon, Coventry, etc., and consisting of a vertical strainer rotating about a horizontal axis, the solid matter being raised from a central receptacle by an Archimedean screw, the most that can be said is that the grosser matters are removed. But even here, a considerable play of water upon the gauze is required to ensure its action. It was formerly a common practice to strain the sewage through wooden planks perforated with ¾-inch apertures, before applying it to land (as at Newcastle-under-Lyme, Southam in Warwickshire, Aldershot), a proceeding that reduced the suspended matters some nine or ten per cent.

Of the attempts at filtration, the following cases may be noted: —

(1) Gravel was used at Abergavenny, Alton, Ashby de la Zouch, Atherton, Cheltenham, Coventry, Ludlow, Oswestry, Saffron Walden, Southam, Tewkesbury, Walton-on-the-Hill,

(2) Burnt gravel was tried at East Barnet.

(3) Cocoa matting and gravel strainers were tried at Wellingborough.

(4) A filter of gorse, with broken stones, was tried at Ulverstone.

(5) Charcoal, or coke, or ashes, were used at Bacup, Bishop Auckland, Canterbury, Chelmsford, Chesterfield, Croydon, Uxbridge and Bilston.

(6) Straw strainers, with ash-filter beds, were tried at Bilston and at Canterbury. Straw filters alone were used at Buxton.

(7) Charcoal and gypsum were tried at Bury St. Edmunds.

(8) Charcoal and gravel filters were tried at Ealing, Fareham, Harborne, Newcastle-under-Lyme.

(9) A filter bed consisting of straw, dry earth, ashes, sand, heath, and burnt clay was tried at Hurstpierpoint.

(10) Peat was tried at Bradford. (1873).

(11) Sand was tried at Ely, Rugby and Birmingham.

(12) An iron slag filter was used at Merthyr Tydvil.

A combined system of subsidence and filtration has been attempted on many occasions. This method was formerly adopted at Birmingham, where the sewage was conveyed through a series of tanks, the passage occupying about two hours. Two sets of tanks were employed, each set being worked continuously for about a fortnight, when the sludge was removed and consolidated by evaporation and soakage in properly-prepared pits. The effluent water was found to be offensive, and the works a nuisance. Coventry formerly adopted a similar process, a coarse gravel filter running the whole length of one tank being employed, through which it passed into a second, and again into a third tank of small gravel. The purification proved very inefficient.

At St. Thomas, adjoining Exeter, a similar method of defecation by subsiding tanks, iron strainers, and gravel filters (forming the tank boundaries) was adopted, although in this case a little lime and about 0.75 gallon of carbolic acid to 200,000 gallons of sewage, were added. The carbolic acid proved valuable.

At Uxbridge again, a combined system of subsidence, straining through a grating, and filtration through charcoal is adopted, before the sewage is discharged into the Colne. It is, however, quite certain that mere subsidence and filtration, as methods of sewage treatment are failures.

We may here mention the suggestion of Strang, of Glasgow, of treating the sewage discharged from a water-closet, by upward filtration through a box containing the refuse ashes of the house. By this means the solid matter is retained in the lower part of the vessel, and the liquid matter passes through the ashes. Dr. Anderson, of Glasgow, reports well of the apparatus. Mr. Austin, late of the Local Government Board Office, was of opinion that sewage might be dealt with by placing a series of portable filters in the sewers. (Society of Arts Conference, 1877, p. 14). By this means much of the kitchen stuff could be kept out of the sewers, which, it is true, is often as objectionable as, if not more objectionable than the sewage itself.

Whatever filtering material you use, be it sand, gravel or charcoal, two difficulties are inevitable: (1) That the filter soon becomes choked, when it fails to act, or acts inefficiently; (2) that the matters deposited on the surface of the filter, cause an insufferable nuisance It may be said, as regards the first objection, you have only to recharge your filters and to utilize the old material for manure. The answer is, the cost of material and of labor, and the difficulty of securing a sale for your refuse. To meet the second objection it is said, "Cultivate the surface of your filter beds, whereby vegetation can be made to use up the obnoxious matters." In practice, however, this is not successful, whilst it is impossible to secure a crop all the year round.

I know of no place where filtration alone has proved a success hygienically. Of course intermittent downward filtration is practically land filtration. The objections urged to general filtration, apply equally to land filtration.

Some interesting details respecting the filtration of the foul water of the River Plate is given by Mr. George Higgin ("Proc. Inst. Civil Engineers," vol. lvii). They show the extreme difficulty of filtering this impure water, a difficulty which is nothing compared to that of filtering sewage.

DISCHARGE OF SEWAGE INTO THE SEA.

Seeing sewage is worth so little, it is no wonder that local authorities have been desirous, where possible, to get rid of it by permitting its discharge into the sea (see Hawksley's Social Science Address, 1876, p. 28). This has been done at Weston-Super-Mare, St. Leonards, Torquay, Eastbourne, Llandudno, Dover, Carnarvon, Brighton, Margate and Ramsgate. There is much to be said in favor of this method. No doubt it appears wasteful, but nature is certain to utilize in due course in her own way what we fail to utilize in ours. But it must be noted that a nuisance is possible if the sewage be discharged into the sea too near land, from the foul matters in suspension being brought back again by the tide to putrefy on the shore during low water. This was said to have occurred at Dover ("*Proc. Inst. Civil Engineers*," vol. xliii. p. 221), and at Carnarvon. A stink may result, moreover, from the reduction of the sulphates of sea water to sulphides by the organic matter in the sewage, and the evolution of sulphuretted hydrogen by the action of carbonic acid on the sulphides so formed. Possibly to some such cause the smells and unsanitary condition of the Bay of Naples, the Port of Marseilles, the Bay of Cadiz, the West Coast of Africa, and other places owe their origin. This difficulty is worth considering, moreover, more particularly in those cases where a town extends down to the water's edge. No doubt further sewage matters, flocculent materials, corks, etc., have a special tendency to float on sea water, continuous decomposition resulting. Difficulties have arisen at Margate, Ramsgate and Brighton, from these several causes.

Evils resulting from the discharge of sewage into tidal rivers, containing sea water have occurred at Glasgow and towns adjacent, where the sewage was taken into the Clyde, and were investigated by Sir John Hawkshaw in 1874, who recommended its discharge into the Firth of Clyde at Farland Head. The discharge of sewage into the Thames was also a subject of inquiry by a Royal Commission, and was discussed by Professor Stanley Jevons in a letter to the *Times* of December 2, 1878. I need only point out that the discharge of sewage into a tidal river involves cost of dredging (See Rivers Pollution Commission, 2d report, 1868, p. xiii).

Regarding sewage (which I do) as a thing to be got rid of, and for which we must be prepared to pay to be rid of it, there are manifest advantages in taking it out to sea or estuary. It should, however, in such cases, be discharged in deep water, at a considerable distance from land below the line of low water, and where there is a well-ascertained current to carry it permanently seaward. Careful tidal observations are needed before deciding on the point of discharge. A spot where there is an oscillating action resulting in a return of sewage matter either in the neighborhood of the discharge, or at distant places to which the tide carries it, must be avoided — in other words, we must not allow a turn of the tide to carry one person's refuse to somebody else. It is difficult to imagine a nuisance resulting under carefully considered conditions, more particularly if the discharge-pipe be some distance from the town, and the town itself well above the sea level. Still, even in all cases, it is worth considering whether or not some process of clarification may not be advisable.

It is worthy of note, that chloride of magnesium is itself a precipitating agent for sewage. Again, sea water, owing to the common

salt present in it, has a tendency to reduce the ease with which organic matter is oxidized. Thus the oxidation of the organic impurity of the sewage is less rapid when it is discharged into salt water, than it is when discharged into fresh.

In the "mud inquiry," the Conservators of the Thames contended that certain sewage banks in the river were caused by the sewage outfalls at Barking and Crossness. In time, these sewage deposits putrefy, rise to the surface, give off offensive gases, ultimately sinking to undergo fresh putrefactive changes. It is certain that in a tidal salt river, foul banks of sewage mud may form, which in ordinary rivers would not be produced. Of course, I admit that a strong tidal current might carry these masses away, but in the absence of such current, they subside and mingle with the sand and mud of the beach.

The bill of 1875, promoted by the West Kent Main Sewerage Board, was for the purpose of conveying the sewage of Bromley, Beckenham, Hayes, Orpington, Chislehurst, The Crays, Bexley, Crayford, East Wickham, Erith and Dartford, to Long Reach on the River Thames, eight miles below the outfall of the metropolitan sewage.

PRECIPITATION PROCESSES.

By "chemical precipitation," or "the chemical treatment of sewage," is implied the addition of certain chemicals to the sewage, whereby the deposition of the solid suspended matters and some of the dissolved matter from the formation of insoluble compounds, together with the deodorization of the offensive constituents precipitated or dissolved, is effected.

The general features of a chemical process for sewage may be thus described: —

To the sewage (from which the grosser suspended matters may or may not be removed), chemicals are added, either suspended in water or, if soluble, dissolved in water. After this treatment the sewage is allowed to flow into subsidence tanks, where either it is allowed perfect rest for a few hours or is passed through a series of tanks continuously, in order, in either case, to allow the deposition of the sludge — that is, of the matter in suspension. The clear effluent is then allowed to flow either directly into a water-course, or over land previously to its discharge. The black fluid or sludge in the tank (of which 90 per cent is water) is then all that remains to be dealt with.

The precipitants to be employed have been subject matters of numerous patents. Of these we shall note the most important.

I. — PROCESS INVOLVING THE USE OF LIME AS THE CHIEF PRECIPITATING AGENT.

Lime. — The use of lime for disinfecting excreta was the subject of a patent in 1802 (Estienne). In 1844 lime was used to purify the Manchester sewage before discharge into the River Medlock. This was done at the suggestion of Dr. Clark of Aberdeen, who, at that time, was at work at his process for softening water by the use of lime, and, as the result of which he was led to suggest its use for sewage precipitation. It was abandoned for a time at Manchester on the ground of cost (a ton of lime being required daily), but was readopted in 1854, at the suggestion of Crace Calvert, who advised, after the addition of two or three grains of lime per gallon, complete rest of the liquid so treated in subsidence tanks, his report stating that the precipitate subsides rapidly, the supernatent water being clear, colorless and inoffensive.

In 1846 Mr. William Higgs took out his patent for the treatment of sewage in subsiding tanks or reservoirs by means of chemical agents. For the purpose of precipitating the solid animal and vegetable matters contained therein, hydrate of lime (commonly termed slack lime) was preferred. In 1851, Mr. Thomas Wicksteed patented a process for manufacturing manure from sewage, etc., by admixture with lime, collecting the deposit and submitting it to certain centrifugal drying machinery, thus obtaining, to use his own words, "the manure as fertilizing material in a state commodious for transport."

Action of Lime. — When lime is added to raw sewage, a carbonate of lime is first formed. This acts as a weighing material, whereby, if the opportunity be afforded, the light flocculent suspended matters will be carried down along with the precipitated carbonate. In addition to this, however, a certain proportion of dissolved organic matter is also precipitated, the lime forming with the organic matter a compound of uncertain chemical composition.

Crace Calvert, operating on the Manchester sewage, gives the following as the average results of five days' treatment by lime: —

	Matters in solution.			Matters in suspension.		
	Total solids.	Mineral.	Organic.	Total solids.	Mineral.	Organic.
Raw sewage.	32.00	23.46	8.54	6.65	3.08	3.57
Effluent.....	25.76	22.26	3.50	0	0	0

The action of lime on London sewage was the subject of a prolonged investigation by Dr. Letheby during the time I acted as his assistant.

In Calvert's experiments on Manchester sewage the lime effected the entire removal of the suspended matter (mineral and organic), and more than 50 per cent of the dissolved organic matter. In Letheby's and my own experiments the removal of all the suspended matter was effected, and about one-fourth of the dissolved organic matter.

The action of lime was further investigated and reported on by Hofman and Witt as one of the most promising of the many processes for obtaining a deposit from sewage, which, when dry, might be employed as manure. Operating on London sewage with 20 grains of lime per gallon (800 grains of lime to 40 gallons of sewage), the following results were obtained: —

	Matters in solution.			Matters in suspension.		
	Total solids.	Organic.	Mineral.	Total solids.	Organic.	Mineral.
Raw sewage.	107.6	52.36	55.24	52.40	36.4	16.09
Effluent.....	96.02	40.34	55.68	traces	traces	traces

In other words, 20 grains of lime removed all the suspended matter, and more than one-fourth the dissolved organic matter.

After the addition of the lime a flocculent precipitate is formed. This settles at the rate of about one-fourth part the bulk of the liquid in one hour. The clear supernatent liquor is colorless, clean, and comparatively odorless. Hygienically, the process is successful — commercially, it is not successful, because the precipitate is mainly carbonate of lime and non-nitrogenous organic matter.

These laboratory experiments are confirmed by practical working. Thus Higgs's process was used at Tottenham in 1857, the results being so satisfactory that the Local Board of Health gave a testimonial certifying to its efficiency (sewage treated 175,000 gallons daily, or sewage of 10,000 persons — 12 grains of lime added per gallon [1 ton per week] — dry precipitate obtained was four to five times the weight of the lime used). That the success was no mere accident is proved by the high eulogium passed on the process by Normandy and Miller in the action brought by Higgs against the Hitchin Local Board for an infringement of his patent.

Why, then, was not this hygienic success continued? The reason

TOTTENHAM.

	Matters in solution.				Matters in suspension.		
	Total solids.	Organic.	Mineral.	Ammonia.	Total solids.	Organic.	Mineral.
Raw s'ge.	54.50	9.49	45.01	2.60	39 99	14.53	25.46
Effluent.	48.99	8.01	45.98	2.84	1.69	0.37	1.32

is obvious — the manure was found to be of so little value that the commercial result proved a failure, Mr. Higgs transferred his expensive works for a merely nominal sum to the local authority, who (in spite of their testimonial showing the capabilities of the process) so neglected them that shortly after the transference an injunction was obtained by the trustees of the River Lea, to prevent foul, undefecated sewage being discharged from the works. Carelessness and parsimony are certain to ruin the best of processes.

Wicksteed's process was adopted at Leicester in 1855, the works

LEICESTER.

Constituents per gallon.	Matters in solution.				Matters in suspension.		
	Total solids.	Organic.	Mineral.	Ammonia.	Total solids.	Organic.	Mineral.
Raw s'ge.	70.00	13.49	56.51	2.52	19.15	5.50	13.65
Effluent	66.99	10.65	56.34	2.61	1.40	0.49	0.91

which cost £30,000 to £40,000 being managed, in the first instance with marked success. [Sewage treated (1858), 2,000,000 daily, or the sewage of 65,000 persons, 3 to 16 grains of lime were added per gallon. Sludge (dry) was 3 to 4 times the weight of the lime used].

Very high was the commendation passed on this process by Aitkin and Taylor, after a minute investigation in 1851. But the Corporation shirked the lime and neglected the works. No wonder that the River Soar, into which the effluent is discharged, became foul, a result which is certain to be attributed by partisans to failure of the lime process rather than to its true cause, viz., the miserable carelessness and false economy of those to whom the management was entrusted.

The value of the sludge precipitated by lime has been variously estimated as from 15*s.* 6*d.* to 29*s.* 6*d* per ton. Voelcker, who fixed 15*s.* 5*d.*, gives the following as its composition: —

		Value per ton. £
Moisture.....	10.52	—
Organic matter.....	12.46	1
Phosphate of lime.....	2.27	7
Mineral matter.....	54.75	—
	100.00	
Nitrogen.....	0.60	—
Ammonia.....	0.72	56

No doubt, as an agricultural article, this manure is worth very little indeed compared to the extravagant views entertained of its fertilizing power by the earlier patentees. Local authorities have to learn that to treat sewage means outlay, and that cost is no excuse for neglect.

I conclude by laying down certain essentials for the successful treatment of sewage with lime: —

1. The lime used should be in perfectly caustic state, and before admixture with the sewage should be thoroughly slaked and mixed with sufficient water to render it the consistency of a thick cream.

2. That the quantity added should not be less than ten grains per gallon, to a sewage that does not exceed thirty gallons per head of the population.

3. That very complete agitation of the lime with the sewage is advisable in order to secure perfect admixture of the lime and flocculation of the precipitate, thus rendering the after subsidence more

No. 572 American Architect and Building News, Dec. 11 1886.

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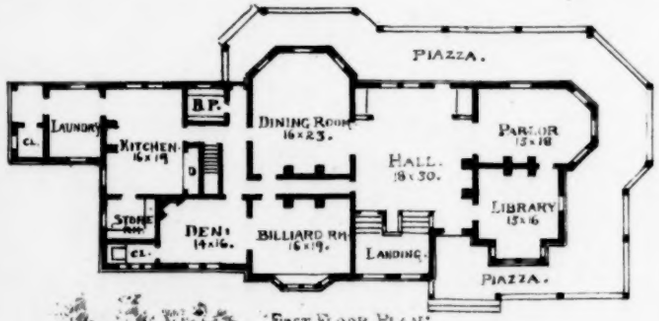

First Floor Plan.

House built near Quogue, L.I.

William A. Bates, Architect,
149 Bway. New York.

Heliotype Printing Co. Boston.

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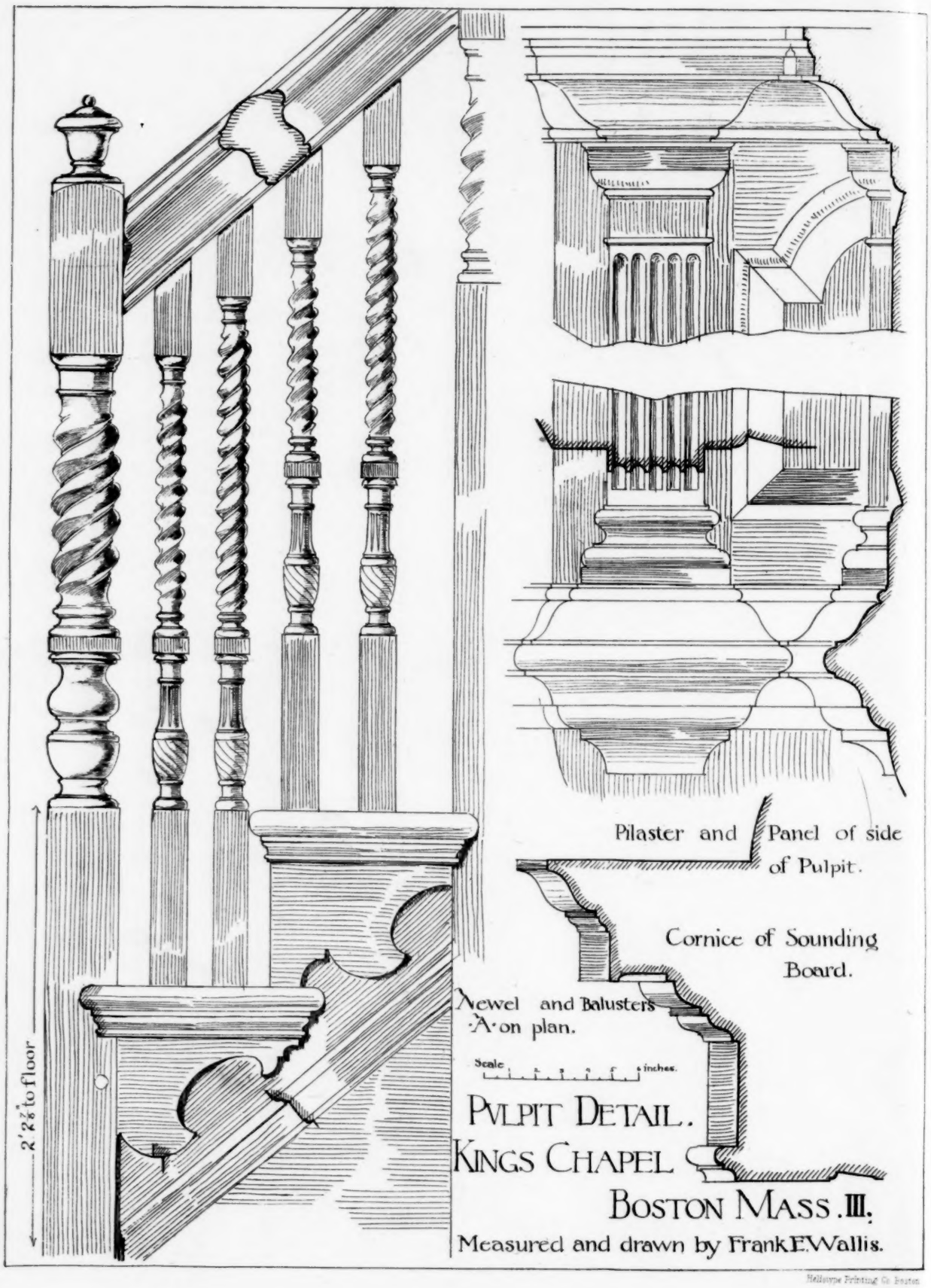
2'2½" to floor
Pilaster and Panel of side of Pulpit.
Cornice of Sounding Board.
Newel and Balusters A on plan.
Scale 1 2 3 4 5 6 inches.
PULPIT DETAIL.
KINGS CHAPEL
BOSTON MASS. III.
Measured and drawn by Frank E. Wallis.

Heliotype Printing Co. Boston.

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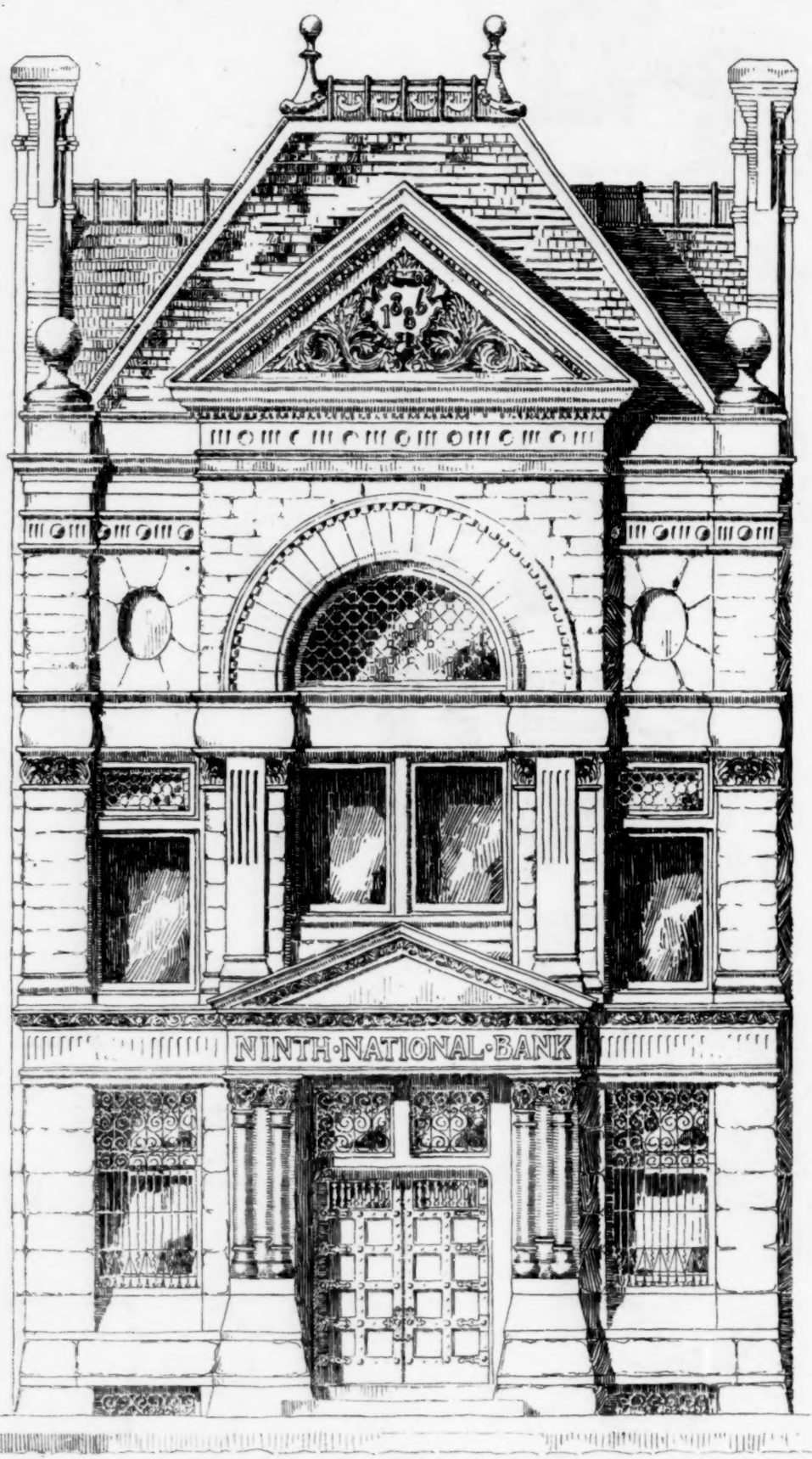
NINTH NATIONAL BANK,

PHILADELPHIA, PA.

HAZLEHURST & HUCKEL,—
ARCHITECTS, PHILA.



SEELER, DEL.

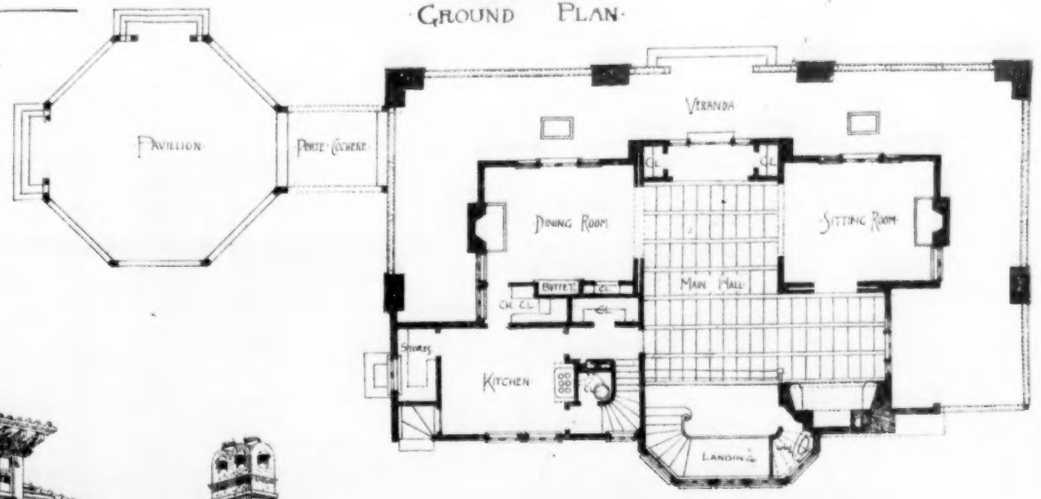
AMERICAN ARCHITECT AND BUILDING NEWS, DEC. 11, 1886. No. 572

RES. FOR H.Q. CLENEAY ESQ., CAVAGNA FARM.

BUDDEMEYER, PLYMPTON & TROWBRIDGE.

ARCHITECTS · CIN., O.

GROUND PLAN.



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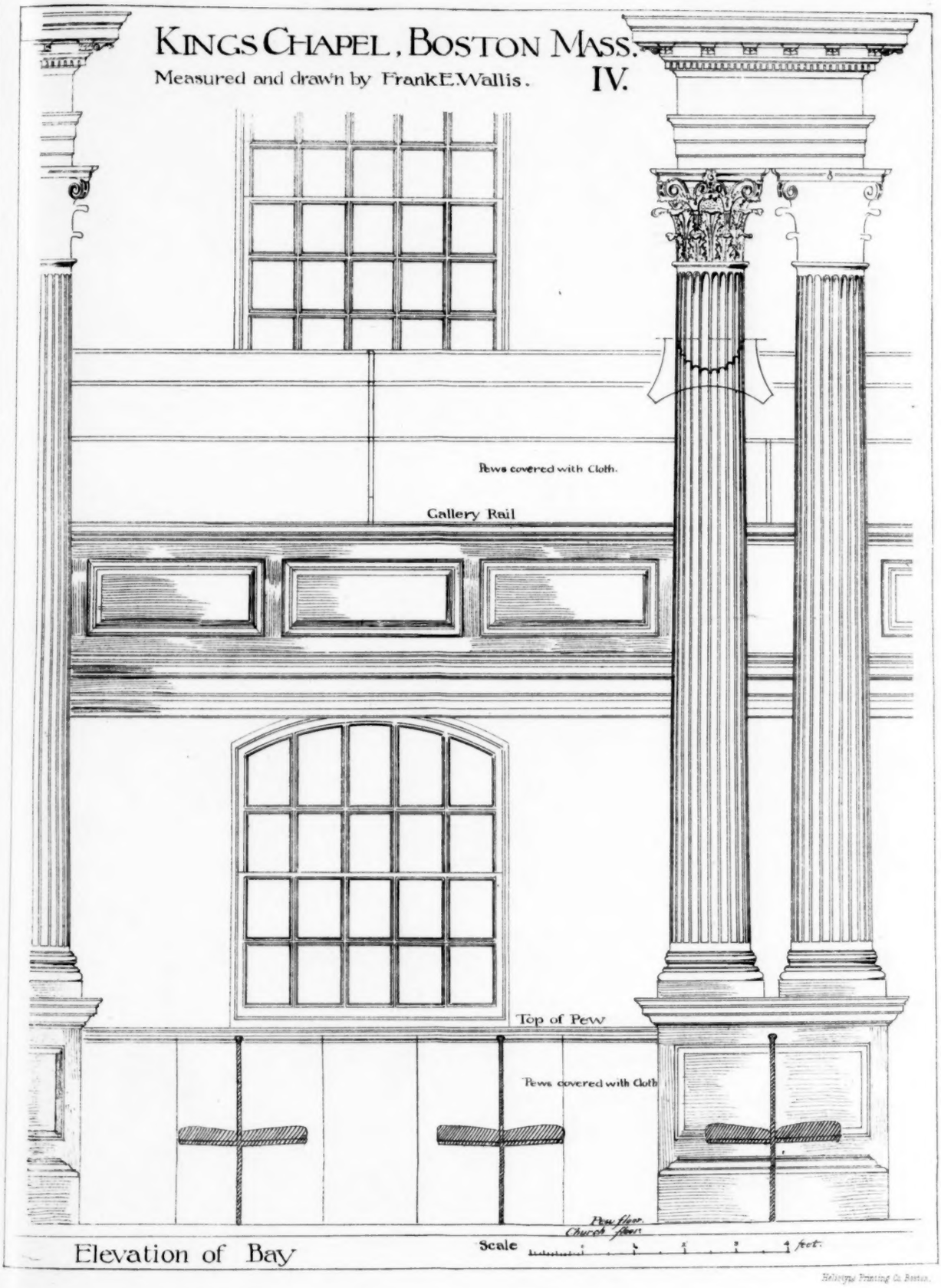

Heliotype Printing Co. Boston.

OLD COLONIAL WORK,

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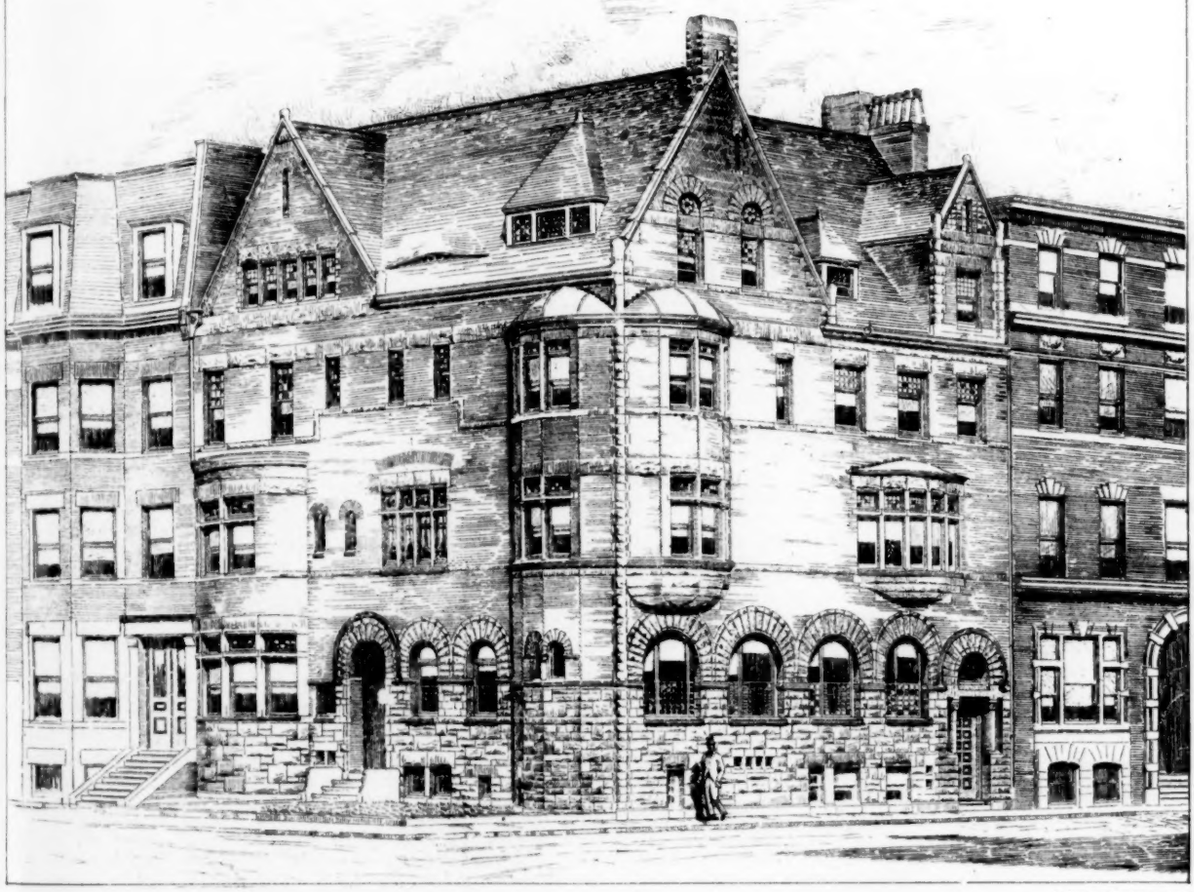
HOUSE FOR MR. E. P. BRADBURY.

W. Whitney Lewis, Archt. Boston.



Heliotype Printing Co. Boston.

rapid. This admixture is effected preferably by means of a paddle-wheel mixer, the axis of which is at the water line of the well in which the mixing process is effected.

4. That after precipitation the defecated sewage should flow over an apron into a tank, which should be at least 4 ft. deep, and capable of holding at least one hour's sewage, and from this into a second tank over a weir placed half an inch below the surface and at the opposite end to the apron over which the sewage enters, this second tank being capable of holding at least four hours' sewage.

5. Or, if this continuous process be not adopted, the defecated sewage should then be allowed to remain at rest in a tank for at least one hour.

6. That the sludge should be removed in summer time once in 48 hours, and after removal be pressed, or otherwise consolidated, and dried with all reasonable speed.

The frequent removal of the sludge is a matter of importance. If this be not done, it putrefies, rises in large flakes, and promotes the decomposition of the supernatent water. It is not difficult by the operation of a dirty tank to undo all the good done by chemical treatment. It will be manifest that a double set of tanks is necessary for successful working.

[To be continued.]

THE ILLUSTRATIONS

[Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

HOUSE OF ELBRIDGE TORREY, ESQ., DORCHESTER, MASS. MESSRS. CABOT & CHANDLER, ARCHITECTS, BOSTON, MASS.

[Gelatine Print, issued only with the Imperial and Gelatine Editions.]

A VIEW of this house from the other side, plans, details and description were published in our issue of April 3, 1880.

HOUSE FOR H. Q. CLENEAY, NEAR CINCINNATI, O. MESSRS. BUDDEMEYER, PLYMPTON & TROWBRIDGE, ARCHITECTS, CINCINNATI, OHIO.

CAVAGNA FARM is about seven or eight miles from the city, and is situated upon the Cincinnati & Northern N. G. R. R. The house contains nine rooms besides bath and toilet rooms, laundry and drying-room in basement, and a thorough and complete system of drainage. The hall is the main feature of the house, and is finished entirely in oak, including floor, staircase, large fireplace, ceiling, etc. In extent it is 15′ x 29′, not including fireplace alcove, 11′ x 13′. Fireplace is built up and lined with salt-glazed, vitrified fire-brick, of a rustic-brown color, and contains a large hood, completely sheltering seats upon either side. All fireplaces are built of this brick, laid Flemish bond, and the hearths of same laid in herring-bone pattern. The hall ceiling is composed of the natural joists, with ornamental as well as efficient bridging, the panels being finished as the remainder of plastering of the house, in New Orleans beach-sand surfacing; flat tinting. The entire constructive parts of the building are of well seasoned Mississippi cypress, mortised, tenoned and pinned together, and all masonry of exterior, down even to the grade-line, to be finished in cement, having finishing coat broomed on with Ladd's Georgia buff lime. The roof to be of $\frac{3}{4}$″ thick tiles of shingle pattern hung on hardwood slats by means of a lug made on the tiles. The face of tiles are moulded roughly in sand, much after the manner of common brick, and have a deep rich, but modest red color. The hip and ridge tiles are of the same material, and are laid in and pointed up with Akron (N Y.) buff cement, "lined up" and joints reddened before the cement sets. The roof-work is to be done by a man who has made it his life business in Nuremberg, Germany. All metal-work to be done in heavy copper. The windows are to be glazed in leaded patterns, for the most part in clear glass, and finishing in style harmonious to the decorations of the various rooms in which they are placed. All the casement windows are to have heavy espagnolette bolts, constructed especially for them. The main rooms of house to be finished in cypress, and pine in attic. The cost complete is but little over $9,000. The contract is not let.

NEW NINTH NATIONAL BANK BUILDING, PHILADELPHIA, PA. MESSRS. HAZLEHURST & HUCKEL, ARCHITECTS, PHILADELPHIA, PA.

THIS building has a frontage of thirty-six feet and a depth of one hundred feet, and is located on the west side of Front Street, below Norris. The front is built of Indiana Lime Stone. Floors tiled and entire building fire-proof; side walls also are tiled to a height of six feet. The banking-room is forty feet high in the clear, and lighted from above through skylight. The rear is two stories high, and contains directors' room and dining-room, etc. The wood used for interior finish is cherry, and building is heated and ventilated by steam. The cost is about $40,000.

HOUSE OF E. P. BRADBURY, ESQ., BOSTON, MASS. MR. W. W. LEWIS, ARCHITECT, BOSTON, MASS.

OLD COLONIAL WORK — DETAILS FROM KING'S CHAPEL, BOSTON, MASS. MEASURED AND DRAWN BY MR. F. E. WALLIS, BOSTON, MASS.

HOUSE NEAR QUOGUE, LONG ISLAND, N. Y. MR. W. A. BATES, ARCHITECT, NEW YORK, N. Y.

EXPLORATIONS IN THE OHIO VALLEY.

COUPLET CAPITALS FROM THE CLOISTER VAISON.

THOSE who were interested in reading the republished account of the results of Professor Putnam's explorations in Ohio will probably feel equal pleasure in reading the following private letter which the *Boston Herald* publishes by permission. This letter shows that notable progress has been made in the few weeks' work of this season toward the solution of one of the most interesting archæological questions before the world — the character and habits of the people who built the various classes of mounds so numerous in the Mississippi Valley. No work of this kind in this country has been taken hold of so intelligently and systematically as this under the charge of Professor Putnam and Doctor Metz, and it should not be permitted to halt for lack of funds. Now, that the two hundred and fiftieth anniversary of Harvard is calling the attention of its friends to the opportunities for extending the usefulness of the institution by the application of their bounty, it may be well to remember that there is no department of the university more deserving of endowment than the Peabody Museum, which, with its future well provided for, would be in a position to do work which, if done at all, must be done quickly, or else suffer great and irreparable damage.

PEABODY MUSEUM CAMP, HAMILTON COUNTY, O., October 2, 1886.

My dear friend: — Since I wrote to you two weeks ago from our camp in Brown County, we have been here, and I have had such wonderful success that I can truly say a new chapter has been added to our archæological work in the valley of the Little Miami. First, you must know that our camp is pitched by the side of the great pile of earth we turned over in our explorations of the group of altar mounds on the land of Mr. Michael Turner. You will remember that we have been working, with occasional necessary intermissions, on this and the adjoining farm of Mr. Benjamin Marriott for the past five years, and that this is the place where we have discovered so much of interest within the great earthwork, of which the following is a sketch:

A hill through which two ditches, thirty feet deep, had been cut, separating the hill into three parts. Around the central portion a wall of earth had been raised, making a perfect circle five hundred and fifty feet in diameter. In this inclosure was a large mound, and near it a small one. These mounds, you will remember, proved of great interest, particularly the large one, with its stone wall four feet high, surrounding an altar of burnt clay. You will remember, also, that we found several human skeletons in the clay outside of the stone wall and two others on the wall, with various objects made of copper, shell and stone. The earth taken from the ditches was used to make the graded way from the top of the hill to the level land below. This graded way connects with an embankment of earth somewhat oval in shape and fifteen hundred feet in its greatest diameter, in which are two openings. Opposite the northern opening is an earth circle three hundred feet in diameter, and in this is a small mound which we have not yet explored. Opposite the eastern opening is a mound nine feet high. It was on this mound that we began our work at this place five years ago. At the foot of the graded way is a small circle enclosing a burial mound. North of this circle were two other burial mounds, and east of it was the great group of altar mounds, around each of which was a wall of stone four feet high, built below the surrounding level of the field. These mounds contained from one to seven altars, formed of clay, on which fierce fires had been made. It was in two of the basins of the altars in the mounds that I found the immense number of ornaments of various kinds, particularly of copper, the sixty thousand pearls, shells, beads, and other objects, also the wonderful little figures of terra-cotta, representing men and women. All these objects had been thrown into the fires upon the altars, evidently as sacrifices, or burnt offerings during an important ceremony. The thirty-seven pits with the singular tubes or "flues" connected with them; the concrete layer of gravel and iron over them; the singular structure of the great mound one hundred feet in diameter and twenty feet high; the great pit containing the many skulls, some of which had holes drilled in them, arranged around two skeletons placed in ashes, all serve to show that, connected with this group of mounds were extensive ceremonies of the deepest import to the people.

These extensive earthworks, made on such an elaborate scale, and containing evidence of the wealth of the builders, as well as of the ceremonial character of the works themselves, necessarily lead to

the conclusion that there must have been a large number of people connected with their construction. The beautiful location of this group of earthworks on the level second terrace which extends for miles in the fertile valley, and is surrounded by hills from which flow never-failing springs, indicate that in this region there must have been a large population; yet the few human remains that we found in the mounds within and without the encircling earth wall are not sufficient to meet the requirements. Such remains were probably those of distinguished persons, buried with special honors, but where were the other dead? Then, the many altars, or basins of burned clay which, evidently, had been used over and over again, and were, with two exceptions, empty when the mounds were erected over them, are indications of cremation, and yet, where were the burnt human remains? Cremation in open fires will, necessarily, leave many fragments of calcined bones with the ashes, unless such remains are burnt over and over again, and special pains taken to reduce all to ashes, and yet we had found, in a niche of the stone wall about the large altar mound, the burnt bones and ashes of but one individual. If these altars were the places where cremation took place, what, then, had become of the remains? These were questions which Dr. Metz and myself often asked of each other, and we felt confident that somewhere near by there must be a general burial-place for the common dead, and many a hunt was made for surface indications. On the north and south sides of Mr. Turner's barn and west of the large circle, are two scarcely-perceptible ridges (O. P.) similar to other slight irregularities here and there over the field. Owing to the cultivating of this place for many years, and to the tramping of cattle in the barnyard, these ridges have been more or less worn down, and a few water-worn stones have been exposed on the surface. These were first noticed by Dr. Metz about a year ago. As soon as our camp was pitched we took a look at these water-worn stones. They were fragments of limestone filled with fossils of the silurian age, lying on a deposit of gravel over which, long ago, had flowed the waters of the Little Miami. What more could these stones have said, had they been endowed with speech, than that which was evident to our eyes: "We were long ago brought here by men." Here, then, was something more to be revealed in connection with the history of these great earthworks of an ancient race, and here we would dig a trench on the morrow. We started our trench sixty feet west from the wall of the circle, and well outside of the slightly-elevated portion, which, we were afterwards told by Mr. Snyder, who remembers the place fifty years ago, was formerly much more marked, and had the appearance of a long, low mound. Digging down to the hard pan, we carried our trench westward for about ten feet, when we came to three large water-worn stones regularly arranged, side by side, in the gravel hard pan. It is necessary for you to fully understand the character of the earth in which we were working in order to appreciate the labors of the ancient people at this place, and I may well add our own, in making these researches. First, the surface consists of a few inches of dark soil overlying from eight to ten inches of clay. Under this clay is a layer of coarse gravel, containing many pebbles, some of considerable size, but all colored and firmly cemented by an amount of iron which, from some natural cause, is far in excess of that in the gravel all about. This iron-cemented gravel forms an irregular layer of from one to four feet in depth, and under it is a loose, uncolored gravel mixed with sand, which, judging from a pit near by, is certainly thirty feet in depth, and probably much more. It may be that this is part of the great terminal glacial moraine which Professor Wright has been tracing across the state of Ohio. In this iron gravel the stones we found were imbedded. On cleaning off these stones we found that there were others at right angles to them, and soon we made out that we had at last discovered a grave. Would it prove to have any connection with the people who built the earthworks and the altar mounds? Our hopes were great and they were soon to be realized as far as one grave could tell its story. On carefully removing the earth from the eastern end of the grave, close to the stones, we discovered the toe bones of a human skeleton, and, after several hours of the hardest kind of trowel-digging, we had the satisfaction of exposing the skeleton lying at full length on its back. Its skull, slightly turned to the right, rested on a flat stone at the western end of the grave. On the left side of the skull was a large sea shell of the genus Busycon, from which the central portion had been removed, a common method of making vessels among the various peoples of America, and often found in burial-mounds and graves from the Gulf States to Michigan. With the bones of the neck were several shell-beads, also of a common form, and as widely distributed over the country as the Busycon shells. The arms were extended at full length along each side, and enclosed by the bones of each hand, resting on the hips, was a spool-shaped ornament (which our explorations have proved to be ear-ornaments), made of copper, and like those found with several of the skeletons in the mounds of this group, and the large number found on the altar in the great mound of the group. We have, at the Museum, ear-ornaments of this character, from burial-mounds in various parts of Ohio and west to the Mississippi in Illinois, and from Central Tennessee, but I have never found them in any of the several thousand stone graves of the Cumberland Valley, which I have explored, nor have we found a trace of them among the several thousand graves associated with the singular ash-pits in the cemeteries which we have explored in the Little Miami Valley, nor with the skeletons buried in the stone mounds, nor in many of the simple burial-mounds of Ohio. They seem to be particularly associated with the remains of a people who practised cremation to some extent, and who built many of the great earthworks of the Ohio Valley. That it is an ancient form of ornament, made from native copper, there can be no doubt, although they may have been made also by the descendants of conquerors of this people in later times; and it is not at all improbable that the form of the ornament may have survived in the time of contact of the "red race" with the white. I can only say that, in all the recent Indian graves I have opened or know about, this peculiar character of ornament has not been found; and if they were ever made by the whites and furnished to the Indians, I have never happened to find any that showed evidence of the fact. We have certainly found them under such conditions in Ohio that they must have been buried with their owners long before the discovery of America. Then, again, all we have found have been made by hammering pieces of native copper, and not by casting the metal.

By the side of the right tibia of the skeleton in the grave was a copper pin, a wooden bead covered with thin copper, a few long, slender flakes of flint, and a fragment of some kind of an ornament made of shell. These long flint knives are of the same shape and character as the well-known obsidian flakes from Mexico, and we have found them, as a rule, associated with copper ear-ornaments like those in this grave. They are sharp-edged, and are as good knives as the Mexican flakes. While speaking of them in general terms as flint, they are in reality flakes struck from several varieties of stone, many of them being of a bright-red jasper and others of chalcedony. The wooden bead covered with copper is of the same character as others we have taken from the burial-mounds in which we have found the copper ear-ornaments. Close to the right hand and hip, but two inches above them, and covering a space a foot in diameter, were a mass of fragments of burnt human bones, with bits of charcoal mixed with ashes. These remains of a cremated body had been gathered from the place where it had been burnt, brought to this grave and placed by the side of the body at the time it was laid in the grave. The close contact of the remains to the finger-bones of the skeleton, which were not disturbed, was sufficient evidence of this. Here, then, in one grave, we had found the evidence associating it with the altar-mounds and the rest of the earthworks about, independently of the fact that the grave itself was within the earth-wall surrounding all the other works. We had found, evidently, the burial-place of the people, and this was abundantly confirmed as our work progressed.

We have now for two weeks been engaged in exploring this burial-place, and during this time we have discovered eighteen graves, four large, deep pits, and several holes dug in the gravel, as well as places where there had been fires, and numerous other interesting facts, many of which, by themselves, would be trivial, but which, when they are all put together, will give a far better idea of the customs and works of the people who made the great earthworks in Ohio than it has been possible heretofore to obtain. All other explorations in the State have been fragmentary. No other systematic work has been attempted, and hence we have had plenty of theories built upon partial facts. We have much to do before the exploration is completed even of this single group. The question is, simply, will friends help us to pay the cost. With money for this purpose, we shall be able to continue these important researches. So far, generous friends have supplied it, and all we can do is to work on as long as possible and hope for further aid.

To give you a detailed account of all we have found during these two weeks would, I fear, draw too much on your patience, notwithstanding your great interest in the work, and I shall only call your attention now to a few of the more interesting points. Of several of the graves, Mr. Kimball has taken photographs, and when they are printed you will obtain a better idea of the graves than from any description I can give. Individuality had its exemplification in this old cemetery, the same as it has in our modern ones, and the modifications are so great that no two of the graves thus far discovered are alike. In one instance there were no stones about the skeleton; in another a carefully-built wall had been made of long, narrow, flat stones, and a regular wall, four layers high, had been made in the same way that a mason lays bricks, but without mortar. In some graves flat stones were placed at the bottom; in others the skeleton was firmly embedded in the gravel, while in one the body had been placed in a thin layer of clay placed over the gravel. In one grave there were two skeletons, one extended at full length on its back, and the other crowded into the grave by the side of the right leg of the first. A child was placed in a small circular grave, the body having been so arranged that the head and the feet were not far apart. Most of the graves were comparatively shallow, extending from six inches to a foot into the layer of gravel. The deeper the grave the better the condition of the skeleton. One grave was dug to the depth of nearly four feet in the gravel, and was seven feet long by four in width. At the bottom was a pavement of flat stones, forty-nine in number. On these stones the body had been extended, and the grave had been filled up with over three hundred stones, all of which had been brought from the river-bed, nearly a quarter of a mile distant. Over these stones six inches of gravel had been placed, around and over which other stones had been regularly arranged. The free percolation of water through the stones had filled up the grave and caused the skeleton to decay, only a few fragments being left. The graves were not covered with large stones, as is the case with the stone graves of Tennessee, and there is but little in common between

the two. Another class of graves were basin-shaped, small in size, and carefully made of flat stones. In them we found burnt human bones and ashes. In one was a pipe carved from stone, which had been burnt with the body, and, in another, were fragments of a burnt copper ornament.

I must give you an account of the graves which were of particular interest. Grave No. 5 in our note-book was six feet six inches long, two feet nine inches wide, and one foot eight inches deep, measured from top of the stones. It was made with care, and the stones were carefully placed so as to form a substantial wall. The bottom was completely covered by four large, flat stones, on which the skeleton lay on its back. The skull was at the east end of the grave. When the body was put in the grave the knees were drawn up, the left hand rested on the body, and the right was laid straight along the side. The result was that the bones of the left hand were found in close contact with the upper ends of the tibia, which had fallen down between the femora. In the bones of each hand was a copper ear-ornament like those I have mentioned. In the corner of the grave, near the bones of the left foot, was a large sea-shell, from which the central portion had been cut away. Near this was a little cup carved out of stone, two canine teeth of a bear, each with lateral perforations, and in each tooth was the chalky remnant of a large pearl. Close to them was a large crystal of galena, and a knife made of a long flake of flint. On the same side of the grave, nearly opposite to the shoulder and partly under the side stones, were eight of the copper ear-ornaments in a bunch, and under them a long bone point. We did not discover them until we had taken out the skeleton and began to remove the stones, for it is our rule always to remove everything placed by human hands, and to turn over every inch of dirt previously disturbed. On taking up the flat stones, which were firmly imbedded in the gravel, and had their edges covered by the side stones, we found the following articles, which must have been placed where we found them before the stones had been put down. Under the second stone (there was nothing under the first) near the centre was a copper bead and small thin pieces of iron, probably meteoric, but it has not been analyzed, and it may prove to be bog-iron which has formed in that place. As we have found several ornaments made of meteoric-iron on the altars of the mounds in this group, as well as two good-sized pieces of an iron meteorite, I strongly suspect that this iron will prove to be the same. Under the third stone were two discs or halves of a copper ear-ornament. These were several inches apart, and must have been so placed when the stone was put down. Near these was a wooden bead, with a thin covering of copper. Under the next, or fourth stone, were several of the long flint flakes or knives, and eight inches from the edge of the stone was a small copper celt. These deposits, under the stones of which the body was to be placed, certainly suggests the offerings of friends at the time the grave was prepared, and the various other objects placed in the grave with the body can, with equal reason, be looked upon as the property of the deceased, or as friendly offerings. At all events, they are important as proof that the individual buried here belonged to the people who built the mounds, as these several objects are of the same character as the many we have found on the altars, and with the few skeletons in the burial-mounds of the group.

Grave 15 of our notes was remarkable for the care with which the walls, sixteen inches high at the head and foot, were made of four layers of flat stones, while along the sides, in the clay above the gravel layer, were simply a row of stones. The skeleton was lying firmly imbedded in the gravel, extended at full length on its back, with the skull at the west end of the grave, while the toe bones were against the opposite stones. The skeleton thus extended the full length of the grave, which was six feet three inches. As with nearly all the adult skeletons, there was a copper ear-ornament in the bones of each hand. On the breast bone was a copper band. At the neck were two shell beads, and near the left shoulder was a flake knife. A few inches from the left foot were about twenty of the long flake knives, carefully laid together, as if they had been wrapped in a piece of skin or cloth when placed in the grave.

With two other skeletons we found celts made of soft coal. These were perfectly made, with fine, smooth edges and polished surfaces, in exact imitation of the ordinary stone celt or hatchet; but, as they would have been worthless for the uses to which stone celts were put, it is likely that they were ornamental or ceremonial objects.

I will allude only to one more grave, No. 18, of our notes. This was marked by a mass of gravel a little over seven feet long and nearly three feet in width, around the edges of which were small stones eight to twelve inches long. This mass stood up eight inches from the gravel layer under the clay. Removing these stones and gravel we found loose gravel filling a pit just seven feet long and three feet four inches wide. At the depth of two feet we came to hard undisturbed gravel, and on this was a human skeleton extended at full length on its back, with the skull at the southeast end of the grave. The bones were firmly embedded in the gravel, and so dry that great care was necessary in removing this matrix. However, after six hours of unremitted labor with small trowel and brush, they, and the several objects associated with them, were all uncovered and left in place, even to the finger and toe bones, and a photograph was taken showing everything in place. In each hand was one of the copper ear-ornaments of the kind I have referred to so often. The finger bones were so arranged as to show that these ornaments had been clasped in the hands at the time of the burial of the body. Another of these ornaments was on the neck bones in contact with the under jaw. On each side of the copper ornament was a canine tooth of a bear, with the lateral perforations. Partly over the bear's tooth, on the left side, was a piece of native copper, which had been hammered roughly into a flat, thick, irregular sheet. This is without holes, and is probably an unfinished ornament. Above this, and close to the skull, was a small copper cone, like many found on the altar of the great mound. Near the right shoulder was a large sea-shell like the others I have mentioned. This skeleton, as it lay in the grave, measured five feet ten inches from the top of the skull to the top of the great toe, and the individual was not far from five feet four inches in height when living. With the exception of a portion of the sacrum, which had entirely disappeared, this skeleton was taken out in a perfect condition. The decay of the sacrum was owing, probably, to the fact that a small round stone had fallen in such a way as to allow water to percolate around it.

This skeleton is a good illustration of the absurdity of the common notion that as soon as skeletons, which have long been buried are exposed to the air they fall to dust. I always have a quiet laugh when I read notices of that kind, and you may put all such accounts down to the inexperience and clumsy work of the persons removing the skeleton. The fact is that it requires great care to remove the earth from about the bones, and very few persons will take the time to do it properly. As soon as a bone is uncovered most persons attempt to remove it at once, and, of course, it goes to pieces. Now, if a skeleton is in dry earth or gravel, and is very dry and crumbling, the proper mode of procedure is to uncover the bones with great care, loosening the earth with the point of a small, flat trowel and removing it from the bones by means of a small broom, or clothes-brush, then let the moist air come in contact with the bone, or, if the air is very dry and hot, sprinkle the bones with water and let them absorb all they will. In this way the particles of bone swell and interlock, and, after a while, the bone can be safely taken up by avoiding force in removing it from the earth. In case the bones are in a wet clay or earth the matrix must be removed with great care. In such cases the bones are soft and spongy, and they must be allowed to remain in place until they have dried off; but they must not be exposed to the full heat of the sun, otherwise they will crack and splinter as they dry. Of course, instances often occur where we find only minute fragments of a skeleton in a grave, all the rest having passed through a chemical change and been reduced to its earthly particles; but that every bone found in a grave can be preserved by using proper care I know from long experience to be the case. I may also call your attention to the fact that the state of perfection of the skeleton, outside of certain limits, is not evidence, by itself, of the antiquity of the bones, as the conditions of burial, as well as the character of the bones, must be taken into account.

In our exploration of this burial-place we found there three large pits, which were covered with gravel and stones, like the grave I have just described. These pits had been dug through the compact iron-cemented gravel below the clay, even to the depth of five feet, and all the material taken from them had been carried away. The pits were then filled with ashes and burned earth, and covered with several inches of gravel and stones, like a grave. The sides of the pit were not burned, so it was evident that the ashes were not from fires on the spot. There were several places uncovered by our excavations near these pits or graves where fires had been made on the clay or gravel, but the ashes had been removed, and hence it is probable that they had been put in these carefully marked pits. But what had become of the gravel taken from them?

You will remember that in the great mound of the group of altar mounds, there was a layer of gravel two or three inches thick, which we have called the concrete layer. This gravel was cemented by a large amount of iron, and it has been a puzzle where the iron came from. It was far too great in amount to have been derived from the clay in the mound above, and, besides, the gravel of the same layer about the edges was loose and light without any mixture of iron. Now, this iron gravel from the burial place is of the same character as that forming the concrete layer in the mound, and it, therefore, seems probable that these pits must have been dug for the purpose of obtaining it. As this gravel had been used during the extensive ceremonies which must have taken place at the time the mound was constructed, the very place from which it was taken seems to have been held sacred, and the pits, therefore, filled with burnt material, covered over and marked in the same manner as some of the graves. This again, is further evidence of the connection of the burial place and the ceremonies which took place there with the altar mounds. The more we examine into the details of this wonderful group of ancient works, the more interesting and instructive they become. We have already spread before us the outlines of a grand picture of the singular ceremonies connected with the religious and mortuary customs of a strange people. There are still some touches to be given before the picture is complete, but it is more perfect than any other that has been drawn, and as our work goes on, we may yet be able to fill it out, and finally present it as a perfect whole. Unfortunately, other duties call me home at once, and for some months I shall not be able to give personal supervision to the work, but it will be continued under the direction of Dr. Metz so long as the money in hand holds out. Will more be forthcoming to enable us to keep on to the end? Friends to the cause of American archæology must answer this. On my way home, I shall visit the serpent mound again, and will try and write to you from that wonderful monument of an ancient race. Yours very truly, F. W. PUTNAM.

SO-CALLED BRIBERY OF ARCHITECTS.

SEVERAL weeks ago we received from several architects in New York and Boston copies of a circular issued by a business firm which, although it was headed "confidential," did not appear to be one of those flagrant attempts at corruption which we are willing to expose, but rather an offer of a trade discount such as business houses may and do issue every day without departing in any particular from the strict path of mercantile morality. As we had done in other cases, we addressed a letter to the firm explaining the peculiar attitude of an architect as toward his client, and giving them an opportunity to withdraw the circular or explain their real meaning. They have chosen the latter course, and have sent us the following statement, which we trust will be as satisfactory to the architects who lodged their complaints in our hands — and whose nice sense of propriety we cannot too much applaud — as it is to ours:

New York, November 19, 1886.

To the Editors of the American Architect: —

Dear Sirs, — Your favor of the 15th to hand, and contents carefully noted.

In regard to our "confidential" circular issued to architects, would state that we have issued quite a number of them to architects in New York and Brooklyn, not, however, with the slightest "evil intent," or with the idea of "corrupting" any one. The whole matter is simply this, the construction of our rail requires that they be made in sizes to fit each particular opening, therefore, it is almost impossible for hardware men to keep a supply of them on hand, and they simply order them from us when they have a positive order for some. And we know of a great many instances where our rail has been called for in specifications, and when a hardware-dealer or his agent figures on a job, he has, in many instances, tried to work off either the common floor-rail or some patent hanger that he has in stock, and very often does not hesitate to misrepresent our rail, and say it is no good, and even says he knew of cases where it was put in and had to be taken out because it did not work.

We have worked very hard to try to get this rail introduced here, and it has cost us a great deal of money, and the results thus far in a pecuniary way are not gratifying, although in every instance the rail has, as far as we can learn, given entire satisfaction. In some cases, where we heard the rail did not work well, we found it was caused, at times, by a wanton disregard of the directions given for laying same, or plaster was allowed to cover it up, and then the rail was blamed. In every case we looked into the matter and rectified the error of others and made everything all right. In offering a commission of ten per cent to the architects on such a thing as this, it would show a very poor conception of their integrity, if it was offered as a bribe, but we know that in many instances the hardware is ordered direct, and the architects wish to save as much for their client as they possibly can, and in offering this commission or discount, we wished to get on the track of places where our rail was to be used, so that when it went in we could follow it up and know that it *worked* satisfactorily. This is entirely separate and distinct from our trade discount, and we did it simply to find out where our rails were located, so that we can *know* they work properly.

The writer knows, from personal experience with several architects, that they are on the war-path about this very circular, but when the matter has been explained to them in the manner in which I have just written, that they are satisfied with their explanation. We have too much at stake, and value our reputation too highly to attempt to bribe any one. If we were furnishing a material that was in the open market, and offered a commission that the contract was to be given to us, it might be assumed that we offered a bribe, and it might lay the party accepting same open to this belief, but it is not so.

We simply wish to get a check on these persons who try and spoil the sale of our rails. We adopt this method after long consideration, and after conferring with parties whom we believe are in a condition to know.

We thank you for your kind consideration in this matter, and assuring you that we appreciate your kindness, remain, Yours truly,

George T. Taylor, *General Agent.*

We believe that the Boston firm of gas-fitters who issued a somewhat similar circular which, to our minds, merely offers a rebate that the architect can secure for his client, is a straightforward business proposition which does not contain the essential essence of bribery, and so do not hold them up to scorn as we have been asked to do.

SOCIETIES

ENGINEERS' CLUB OF PHILADELPHIA.

At the meeting held November 6, 1886, Mr. Frank A. Hill presented a paper upon Accidents in Anthracite Mines.

The impression that the proportion of fatal accidents in the anthracite mines is increasing, which has grown from the occurrence of recent disasters, is incorrect.

The duty of the mining engineer and superintendent is to obtain the greatest yield at the least cost of money and life. The possible yield is more than the market can absorb, and the reduced cost of the coal at the mines shows the improvement in the economy of mining, but this has not been accomplished at the expense of the lives of the miners. From 1875 to 1880 (six years) there was an average of one death for every 98,662 tons mined, while from 1881 to 1885 (five years), the average was one death for every 105,879 tons mined. This improvement is in the face of increased danger from gases, mine-fires, roof-falls, quicksand, water, additional machinery, etc.

Roof-falls kill forty-four per cent of those who lose their lives in the mines.

Carelessness of the men is the greatest danger and the one hardest to meet. The importation of unskilled foreign labor joins ignorance with carelessness in swelling the death-rate. Roof-falls, explosions of fire-damp, and careless handling of powder, furnish at least sixty per cent of the deaths. In almost every case these accidents are due to the carelessness of the men; ten per cent is a very high estimate of the accidents for which officials are responsible.

From 1875 to 1885 (eleven years) in Great Britain the average number of tons mined to one life lost was 130,555; in the anthracite region of Pennsylvania, 102,608.

There are no breakers in England, and as we waste in the breaker one-third of the material hoisted from the mine, fifty per cent should be added to the shipment to obtain our true production. The English miner uses about one-fifteenth as much powder as the anthracite miner, so that fourteen-fifteenths of the accidents from powder, as well as all accidents in the breaker, must be eliminated in a fair comparison. With these corrections made, the average number of tons mined in the Pennsylvania anthracite mines was 181,252 tons per one life lost, as against 130,555 in Great Britain.

The Secretary presented, for Mr. Herman Haupt, Jr., a description of the St. Paul Ice Palace, illustrated by photographs and prints. The structure was of rectangular cruciform ground plan, 180 feet by 154 feet, with principal tower 106 feet high, surrounded by other towers, etc., giving very beautiful and complete architectural character to the building. The principal entrance was under a Gothic arch of 10 feet span and 25 feet high. The blocks of which the palace was constructed were 22 inches by 44 inches by 20 inches, the latter being the thickness of ice. They were marked out on the surface of the ice on the Mississippi River, and sawed at once to these dimensions, which were unchanged afterwards, except where, in round towers, etc., some trimming with axes was required. The blocks were raised in place by ice-tongs and tackle, operated by horse-power. The blocks in walls and arches were cemented with water, which, at the existing temperature, froze almost immediately. The structure was reared in about forty-two days. It was the conception of Mr. George Thompson, of St. Paul.

Howard Murphy, *Secretary and Treasurer.*

COMMUNICATIONS

MILL-FLOORS.

December 4, 1886.

To the Editors of the American Architect: —

Dear Sirs, — I have read the rejoinder of C. to my treatment of the question of mill floors with much interest. I anticipated the reply that the present Building Act appeared to require the longitudinal girder to which I have taken exception. If this requirement exists in fact, it may be one of the few faults in an otherwise excellent building law. My observation of the use of this girder has been limited to buildings which are not intended for heavy storage, which can hardly be put to that use in any event, and which might therefore be treated rightly on a lower factor of safety than that which would be required for a warehouse subject to contain very heavy merchandise.

C will observe that Mr. Woodbury made use of a factor-of-safety of 6, upon a modulus of rupture considerably higher than is given in Trautwine. I am without the necessary technical knowledge either of mathematics or of construction which would enable me to pass upon a question as to the relative merits of the different methods of computation; but the conclusion which I have derived from Mr. Woodbury's treatment of the subject of mill floors in his treatise upon the subject, and also from other experience and sustaining evidence of mill-engineers, is that so far as the floor frame is concerned, the mill-construction could be adapted to all the ordinary purposes of storage as safely as the ordinary joist construction, 12 to 24 inch on centres, without the longitudinal girder.

This is a point which might well be made a subject of discussion among experts. According to Mr. Woodbury's investigations, the following goods would require to be packed ten feet high in order to bring the weights named upon each square foot of floor. I have selected the heaviest articles of customary storage:

East India wool	280 lbs.
The heaviest woollen flannels in cases or bales	220 "

Compressed cotton	250 lbs.
Jute lashings (whatever they may be)	430 "
Heavily sized cotton tickings	370 "
Wheat in bags	390 "
Brown sugar in boxes	450 "

Among the articles which would weigh more per square foot, if piled ten feet high, may be named

Soda ash	620 lbs.
English cement	730 "

but these articles would never be piled so high, or very rarely, inside a warehouse except upon a basement floor.

The articles which might require special consideration would be

Super-calendered book-paper	690 lbs.
Glass	600 "
Tin plates in boxes	2,780 "

these latter articles being in somewhat small packages may be piled very high by hand without putting too much work into the piling.

Are the warehouses in Boston of the ordinary construction built for miscellaneous purposes, consistent with the factor made use of by Mr. Woodbury when built to carry customary loads, and not for special purposes? If they are not constructed on these conditions, is the joisted floor with the longitudinal girder of necessity adopted in place of mill construction of a heavy kind?

The fact is mentioned by C. that if heavy timbers are placed 10 feet apart, 4-inch plank would be required for the main floor; and this would, perhaps, cost more than the ordinary method of flooring.

But there are other reasons than strength for the adoption of the 4-inch floor; it is more *slow-burning;* this point comes in for consideration at the present time, when the necessity has been forced upon owners by the advance in the rates of insurance to avoid combustible architecture, thereby giving architects an opportunity which they never had before to present suitable plans.

We consider the best construction for factory purposes to be spans not exceeding twenty feet in length for the timbers, and spaces not exceeding eight feet on centres. This brings the posts eight feet apart; I am well aware that owners greatly object to the proximity of posts. But herein again comes in the factor-of-safety from fire, especially if iron posts are made use of, subject to be destroyed at very short notice by the heat of a very moderate fire. In this consideration again the skilful architect may have an opportunity to prove to owners in which direction their true interests lie, now that the stock underwriters have undertaken *prevention of loss by fire*, in addition to their previous functions.

I trust that this sort of criticism may not be considered officious. The experience of the mutual underwriters is mainly limited to factory buildings in which the loads are light, as has been previously stated; but when they witness the extremely profitable results of the system of preventing fire in factories, it is difficult for them not to hanker a little for the control and direction of other property which they cannot now insure, in order that they might try their own hands in stopping wasteful destruction.

The gain to a textile manufacturer during the past thirty-five years (the life of the Mutual Insurance Company, of which the undersigned is president), as compared to other methods of insurance, has been this: that the actual dividends which have been returned to the members of this company in thirty-five years, if made use of by the manufacturers in their business at six per cent annual interest throughout the period, will have saved to them in thirty-five years, very nearly, if not quite the entire value of the property now insured in their names, which could have been destroyed by a fire, causing a total loss of everything combustible upon the premises, including building, machinery, stock and goods.

Æsthetically considered, is not the mill floor to be greatly preferred to the naked joists or to the plastered ceiling?

EDWARD ATKINSON.

THE MANHATTAN STORAGE WAREHOUSE PLATE.

BALTIMORE, MD., November 29, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you inform me what the building is, and what streets it is the corner of — the one shown on the extreme right, in your gelatine print of the Manhattan Storage Warehouse, *American Architect* of November 27, and oblige

W. CLAUDE FREDERIC, Architect,

[WE believe it is an extension or an independent adjunct of the Grand Central Depot on Forty-second St.—EDS. AMERICAN ARCHITECT.]

THE RIGHT TO REJECT BIDS.

INDIANAPOLIS, IND., December 1, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — A private corporation advertise for bids on an important structure in the usual form "reserving the right to reject any and all bids." The sealed bids are opened in private by the company's officers, the terms of the bids are not made public, and the contract awarded to one of the bidders, who agrees with the company not to allow the amount of his bid to be known. What are the rights of bidders under such circumstances, and what remedy, if any, has the lowest bidder among those shut out, granting him to be solvent and capable, and his proposed bondsmen above criticism?

Very respectfully, A CONTRACTOR.

[THE bidders have no claim to know the amount of the accepted tender, if the parties immediately interested wish to keep it to themselves, nor has the lowest, or any other bidder, under the conditions of the bidding, a right to insist upon the acceptance of his offer. The reservation made in the advertisement that the company should have the right to reject any and all bids makes this clear, but even where no stipulation of this kind is made it has been repeatedly decided that the party inviting bids has a right to consider other circumstances besides the relative amount of the tenders, and to accept the one which seems, on the whole, most advantageous for him. — EDS. AMERICAN ARCHITECT.]

NOTES & CLIPPINGS

GIGANTIC STATUES OF BUDDHA. — The statue of Liberty just inaugurated at New York, says the *Daily News*, is described as towering "to the skies above all known statues of the present and the past," and as "the Great Eastern of statues." The writer may be excused for not knowing that a much higher statue exists, and has long existed in Afghanistan. . . . These statues are on the principal road between Cabul and Balkh, at a locality known as Bamian. At that place the road passes through valleys, with high scarped cliffs of conglomerate. Probably about the early centuries of the Christian era the Buddhists excavated numerous caves, as monasteries for themselves, in the rock of these valleys. These ancient excavations still exist, and can be counted by thousands. In addition to these, a number of statues of Buddha were cut out of the solid rock. Two, at least, are still standing, and the largest was measured by Captain Talbot with the theodolite; so that we now know the height to at least a few inches. The measurement gave it as 173 feet high; that is rather more by a few inches than the Nelson Column in Trafalgar Square, and nearly 70 feet higher than the New York figure. This figure of Buddha is the real "Great Eastern" of statues. The celebrated Memnon statues of Egypt would only come up to the knee of this mighty *ikon*. At Bamian there is another figure of Buddha, 120 feet high. These are erect standing figures; there is also a sitting figure about 30 feet high, There are the remains of two other figures, but they are in a ruinous condition — one of them is estimated to have been about 50 or 60 feet. These statues were originally, we know, either gilt or covered with metal. The Chinese Pilgrim, Hiouen Thsang, passed the spot in the first half of the seventh century, A. D., and from him we have a description of the two largest figures as they existed at that date. The statues have, of course, suffered from time. Armies have often passed by the road. Genghiz Khan and Timur-Lung's hosts did so, but they had only bows and arrows to throw at the idols. In later times Mohammedan soldiers have passed with artillery, and in their hatred of "Bhuts" or idols they fired solid shot. The idols have, thanks to their great size, stood this treatment very fairly, and, in spite of it the true character of the figures, as well as the art style to which they belong, is still faithfully preserved. — *From a letter to the London Daily News.*

THE CITY OF RHODES. — The city of Rhodes is situated close to the northernmost extremity of the island, facing the mainland, with a north-eastern aspect. In front of it are three harbors, which were originally separated from one another by small spits of land; but these were subsequently improved and strengthened by moles so as to afford protection against the sea. From the shore the ground rises gradually in the form of an ancient theatre, the highest point being towards the West, where it overlooks the sea in the opposite direction. This hill — which now bears the name of Mount Smith, because the house that stands on its summit was the residence of Sir Sidney Smith in 1802, at the time of Napoleon's Egyptian expedition — was the position of the ancient acropolis. But it is by no means a commanding height, and this is probably the reason why no city was built here at an early period; for this site was unoccupied until towards the close of the Peloponnesian War (B. C. 408), when the inhabitants of the three leading cities of the island, Lindos, Ialysos, and Cameiros, agreed to abandon their homes and found a city in common. In other respects the position is admirable for a commercial station on account of its harbors, its nearness to the mainland, and its being a natural point of departure for Egypt and the East. The later glories of the place, when it became the stronghold of the Knights of St. John, and one of the bulwarks of Christian Europe against the Ottomans at the height of their power, have almost eclipsed its ancient fame. Yet Strabo speaks of its grandeur as being surpassed by no other city, and hardly equalled by any (xiv. 2, § 5, p. 652). Its commerce, its political institutions, its school of oratory, and its school of sculpture, enjoyed a world-wide renown. Its strength was so great that it endured a siege by Demetrius Poliorcetes in B. C. 304 and triumphantly repulsed him, though he brought all his force against it for the space of a year. Nor can we forget that it became the residence of many great men; that Cicero studied there, and that Tiberius chose it as his place of voluntary exile. Of the magnificence of that time little remains beyond the Hellenic foundations of the moles and the numerous sepulchral monuments of gray marble — resembling small round altars or pedestals of statues which are met with in the city and the suburbs. But, as a specimen of a mediæval fortress the existing city is almost unrivalled; and the objects that remain there, notwithstanding the ravages of time, illustrate in an impressive manner the organization of the Order of the Knights of St. John. The enormous moat, wide and deep, and faced on both sides with stone; the solid walls, with towers at intervals, forming sometimes a double, and at the highest point, where the palace of the Grand Master stood, a triple line of defence, and drawn in a horse-shoe form over the sloping heights from either side of the central harbor, and along the line of the harbor itself;

and the fortifications by which the moles themselves were protected — all remain unchanged to attest the strength of this bulwark, on which, for centuries, the attacks of its powerful foes broke in vain. — *H. F. Tozer, in the Academy.*

Air from a Cave for House-cooling. — I wish your opinion upon a matter in which I am much interested. Grand Avenue cave, situated four miles from Mammouth cave, contains some nine miles of avenues filled with delightfully cool, pure, dry air; temperature 55°. I propose to erect a house immediately over this cave; make the outside walls and partitions all hollow, so that they may communicate with a cellar, which shall be connected with the cave by a large shaft, say eight feet square. The question is, will the air between the house and cave take the temperature of the cave by diffusion or otherwise, or will it be necessary to use mechanical means to get the air into the building? I have seen and spoken to several scientific men on the subject, who agree with me that an interchange of air will take place and continue until equilibrium is restored by making the temperatures the same. It is proposed to erect a hotel for a cool-air summer resort, and also for a sanitarium. If you think proper, I would like you to put this before the readers of your valuable periodical, and get the benefit of their opinions. It is a matter of some scientific interest, in which physicists, geologists, and sanitarians may be interested. — —*M. H. Crump, in Science.*

Suffocation in Wells. — A painful story of death from misadventure, which in this, as in so many other cases, means death from ignorance or carelessness, was investigated the other day by Dr. Danford Thomas. A prisoner in Pentonville Goal volunteered, with a colleague, to descend a disused well for the purpose of removing pumps. The danger of such a proceeding is manifest, and it is reported that the authorities were warned of the danger, and the jury certainly appended a censure to their verdict. One of the men died, and the other was so much affected that he had to go to a hospital. It is scarcely necessary to remind our readers that the utmost caution should be used before entering any well or confined space. Carbonic acid generates under a variety of conditions, and its action, even in small quantity, is not only poisonous, but paralyzing. The candle test is, when properly used, sufficient. If the candle burns clear and bright to the very bottom, there is no danger; but if it does not go to the bottom, there is always a possibility that carbonic acid, which is half as heavy again as air, may lie there, as in the celebrated Grotto del Cane, in which a man can stand, while a dog is asphyxiated. It is commonly supposed that carbonic acid accumulates only in old or disused wells. This is a dangerous delusion. We were present a few years ago at an inspection of a new well on the estate of our lamented editor, the late Dr. Wakely. The well had only been sunk a few weeks before in a country place remote from houses. It was loosely covered, and one of the men was about to descend for the purpose of inspection, when Dr. Wakely, with characteristic caution, insisted that a candle should be lowered first. It went out before it had gone 6 feet; and it is certain that if the man had gone down, as he proposed, he would have fallen lifeless to the bottom. The generation of carbonic acid below the surface of the earth is apparently capricious. The curious pits or caves, some of them more than 100 feet in depth, which abound in the neighborhood of Bexley, in Kent, contain no carbonic acid, as we can testify from personal experience, although they are said to have been excavated in prehistoric times; whereas, as in the instance already quoted, the gas may accumulate in a perfectly new chamber. The mere extinction of a flame is not a sufficient indication of danger. If the candle burns dimly there is risk, for the gas acts on living beings as on candles, and insensibility, or exhaustion tantamount to it, may be produced by a quantity of carbonic acid which would not immediately kill. — *Lancet.*

Sugar in Cement. — A letter in the *Times* of Wednesday, November 24, written by Mr. Thomas Hankey, points out that cane sugar and lime form a definite chemical compound, which has very strong binding qualities, and forms a cement of exceptional strength. Equal quantities of finely-powdered lime of a common kind, and of good brown sugar, mixed with water, form a mortar which has been found to join stones and even glass with great success. It is important that the lime should be thoroughly air-slaked, for if any dry particles be left they will swell and eventually break the joint. It is stated that this mortar is equal in strength to Portland cement, and that the latter may probably be improved by the addition of sugar, or, perhaps, even of treacle. A number of small experiments which have been made have proved entirely successful, and it now remains to see whether the material offers advantages in actual work sufficient to pay for its extra cost. If this should prove a new use for sugar the news would be received with welcome in our West Indian colonies, which have long suffered from the low prices brought about by the competition of beet-root. — *Engineering.*

In the next issue *Engineering* says: The letter respecting the use of sugar in cement and mortar, which appeared in the *Times* last week, and which was noticed by us, has given rise to some further correspondence. Surgeon-general W. Robert Cornish has written to say that the Indian practice of mixing "jaggery," or unrefined sugar, with mortar in certain proportions, is very ancient. In the latter part of the last century a wall was erected as a fortification to the settlement of Madras, and remained until it was ordered to be removed in 1859. The task proved exceedingly difficult, and the separation of the bricks from the mortar was impracticable. Afterwards the original specification for the wall came to light, and it was found that it required that the mortar should include a certain proportion of "jaggery" mixed with shell-lime and river sand. A copy of the document was published in the *Madras Mail* in 1873. The same writer states that the polished *chunam* walls, for which Madras is famous, are prepared with cement made with unrefined sugar. Another correspondent, Mr. Nathaniel Stevenson, testifies to the beneficial effect of adding an ounce of sugar to each half-pint of water in mixing plaster-of-Paris for models. A third writer mentions the use of "goor," a coarse sugar, as an ingredient of mortar in India. Masonry cemented with this material requires to be blasted before it can be destroyed.

TRADE SURVEYS

All of the larger lumber-manufacturing interests have made unusual preparations for a very heavy production during the coming season. Buyers will not be sorry to see the lumber manufacturers make the very tempting mistakes of overcrowding the markets. To all appearances this is likely to be done even in the face of a very heavy demand which is likely to set in early in the season. In the Northwest, in the two Virginias, and in Georgia, much sawing and logging capacity has been erected during the past few months, and those who are in the best positions to know predict a very heavy supply of white and yellow pine, hemlock, spruce, and poplar, and even walnut, cherry and oak. Some of the older heads in the trade regret that the indications point to such a heavy supply of lumber. The spirit of the trade is to rush in and take the consequences. The cornering of the lumber market is and will remain an impossibility. It would be possible to advance prices to a remunerative point and hold them there, but there is no national organization among the lumber interests, and even were it desirable, it is practically impossible. Georgia is fighting Michigan and Maine, and Pennsylvania is endeavoring to maintain its hold upon the market against many odds. In a word, the available supply of lumber is too far beyond the reach of organization. It is possible that the hard woods can be advanced permanently, but even here the chances are the other way. A great deal of machinery has been put up within easy reach of the hardwood regions, and close attention will hereafter be given to the manufacture of hard wood because of the very general use that is being made of it in the finer class of dwellings. The highest lumber authorities say that there is nothing in the way of keeping margins as narrow in hard woods as in other kinds. The season is at a close. The stocks for the winter are only moderately large. A large amount of lumber will be moved this winter by rail both East and West. A good many new mills will be put up this winter. All of the wood-working establishments furnish good reports as to the present and prospective condition of that rapidly-growing industry. The fact is that at no time has there been a more urgent demand for wood-working and saw-mill machinery and never, in any single year, has as much old machinery been removed and supplanted with new. The lumber question is an important one at this time, and it is pleasing to note that there is very little difference of opinion among the largest manufacturers and dealers in regard to trade prospects. They seem to unite in the verdict of low prices and heavy supplies. Therefore the anticipation of future wants will be entered upon very carefully.

The lists of building permits in New York, St. Louis, Minneapolis, St. Paul, and in some cities of lesser proportions, show that although the building season is over, a great deal of work is contemplated during the winter months. Chicago's October permits were 274 for 293 buildings, and for November 176 permits for 263 buildings. St. Louis permits for November are given at 154, involving the expenditure of about $800,000. Important building enterprises are under consideration along several of the railroads leading north and northwest from Chicago. The builders in Cincinnati and Louisville entertained decided opinions as to the favorable character of next year's building operations. The industrial improvements in progress in Southern States, and which has not been exaggerated, seems to be reflected in an industrial improvement in the larger cities of the Ohio Valley. A great deal of small house building will be done in a multitude of large and small manufacturing cities. More money will be expended by employers of labor in this direction than heretofore. The labor agitations of the past year have directed the attention of employers to the advisability of centering the interests of their working people in their own homes, and quite a number of manufacturing corporations and firms have resolved upon investments in house-building intended to directly benefit their workers, and to indirectly benefit them.

The favorable reports which have been made from month to month in this survey concerning the iron and steel interests, can only be repeated. There are some indications that the iron trade is threatened with a boom. For instance, it is given out officially that 800,000 tons of rails have been sold for next year. This is fully one-half of the productive capacity. Two new mills are under way, and there is talk that three or four more may be undertaken. The industries of the country have been acting very conservatively, but the inducements of heavy business, and strong margins will overcome the conservative manufacturing interests and will lead them eventually into a race for trade which will, no doubt, end as all other periods of great activity have ended. These recurring ups and downs will continue until the problem of a just distribution of the products of labor is solved.

The steel makers are greatly encouraged by the heavy demand for their product. Several of the larger manufacturers have been consulted in a general way for steel for next year's requirements to go into coastwise tonnage, lake crafts, into engineering work, railway supplies, and in a variety of directions. The consumption of steel next year will be at least one-half greater than this, provided that nothing unusual happens to side track some of the huge enterprises that are looming up.

Within a few days negotiations have been opened for large building tracts not far from New York, Philadelphia, Chicago, and two or three other smaller Western cities. Suburban property is improving more rapidly than any other. The strong tendency to a concentration of population is helping in this improvement. At the same time it cannot be overlooked that there is an outflow of small manufacturing enterprise to which taxation and the dearer labor of cities are obstacles. At the same time real estate is improving in value both for manufacturing and residence purpose. Nothing like a speculative feature is likely to develop,

The strong features at this date are the heavy railway traffic and the probabilities of a steady increase, the doubling of our railroad mileage this year over last, and the probability of a fifty per cent increase next year. The evidences of a general increase in production and consumption, the practical unanimity of the public upon all questions of political economy, not even excepting the traffic issue, the growth of industrial enterprise in the South, the expanding opportunities for investment of capital both North and South, and finally, the more favorable prospects of friendly relations between labor and capital. A half-dozen labor conventions of one kind or another will be held during the coming winter. A very important convention has been in session this week at Columbus, Ohio. Another will be held in Cincinnati in February, another in Washington, and one is projected in New York city. There is a general spirit of organization amongst the working classes, but their coming together means nothing of which capital need be afraid.